Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

13-AMRP-0077

JAN 04 2013

Ms. J. A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM NO. 2012-079 AND SUPPORTING DOCUMENTATION FOR THE 100-N-25, FRENCH DRAIN 1 LIQUID WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2012-079, and supporting "Remaining Sites Verification Package for the 100-N-25, French Drain 1 Liquid Waste Site," Rev. 0. If you have questions, please contact me or your staff may contact Joanne Chance, of my staff, at (509) 376-0811.

Sincerely,

Mark S. French, Federal Project Director
for the River Corridor Closure Project

AMRP:JCC

cc w/attach:
N. M. Menard, Ecology
Administrative Record, H6-08

cc w/o attach:
R. D. Cantwell, WCH
S. L. Feaster, WCH
T. Q. Howell, WCH
D. L. Plung, WCH
J. P. Shearer, CHPRC

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-NR-1 **Control No.:** 2012-079

Waste Site Code(s)/Subsite Code(s): 100-N-25

Reclassification Category: Interim ☒ Final ☐

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐

RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☒ EPA ☐

Description of current waste site condition:

The 100-N-25, French Drain 1 Liquid Waste Site was identified as a 100-NR-1 Operable Unit waste site requiring remediation in the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999).

The location of the waste site is approximately 82 m (270 ft) south of the location of the 116-N-2 waste site. The purpose of the french drain is unknown; however, the nearest structure was the 1105-N Administrative Office Trailer, which existed from 1975 to 1986. There were no above or below grade pipelines found to have led to the drain; therefore, it was speculated that the drain was used for water runoff from the nearby office trailer roof or condensate from an air conditioning unit.

Remedial action at the 100-N-25 waste site was performed between March 27 and 29, 2012. The waste site was excavated to an approximate depth of 4 m (13 ft) below ground surface resulting in approximately 333 bank cubic meters (436 bank cubic yards) of soil removed for disposal at the Environmental Restoration Disposal Facility (ERDF). There was no evidence of a french drain found during remediation.

Remediation, verification sampling, and a comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives and remedial action goals (RAGS) established by the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the ERDF, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results supports a reclassification of the 100-N-25 waste site to Interim Closed Out. The current site conditions achieve the RAGs established by the 100-N Area ROD (EPA 1999). The evaluation (which may include fate-and-transport modeling) of all data collected from the waste site resulted in a determination that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep). The results from the base of the excavation also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-N-25, French Drain 1 Liquid Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-NR-1 **Control No.:** 2012-079

Waste Site Code(s)/Subsite Code(s): 100-N-25

Regulator comments:

Approval of this Waste Site Reclassification Form documents the regulator's agreement that the 100-N-25 waste site qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, the lead regulator has evaluated the data for this site against WAC 173-340 (2007) cleanup levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting the lead regulator's approval of the site's reclassification to "Interim Closed Out."

Waste Site Controls:

Engineered Controls:	☐ Yes ☒ No	Institutional Controls:	☐ Yes ☒ No	O&M Requirements:	☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

J. P. Neath	J P Neath	12/4/12
DOE Federal Project Director (printed)	Signature	Date
N. Menard	Nina M. Menard	12/11/12
Ecology Project Manager (printed)	Signature	Date
N/A		
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-25, FRENCH DRAIN 1 LIQUID WASTE SITE

Attachment to Waste Site Reclassification Form 2012-079

December 2012

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-25, FRENCH DRAIN 1 LIQUID WASTE SITE

EXECUTIVE SUMMARY

The 100-N-25, French Drain 1 Liquid Waste Site, part of the 100-NR-1 Operable Unit, is located approximately 82 m (270 ft) south of the location of the 116-N-2 waste site. The purpose of the french drain is unknown; however, the nearest structure was the 1105-N Administrative Office Trailer, which existed from 1975 to 1986. No above- or below-grade pipelines were found to have led to the drain; therefore, it was speculated that the drain was used for water runoff from the nearby office trailer roof or condensate from an air conditioning unit.

Remediation of the 100-N-25 waste site was performed between March 27 and 29, 2012. The waste site was excavated to an approximate depth of 4 m (13 ft) below ground surface resulting in approximately 333 bank cubic meters (436 bank cubic yards) of soil and debris being removed and disposed at the Environmental Restoration Disposal Facility. There was no evidence of a french drain found during remediation. No overburden soil was stockpiled to be used as backfill.

Verification sampling was conducted on July 24, 2012. A summary of the cleanup evaluation for the soil sampling results against the applicable remedial action goals (RAGs) is presented in Table ES-1. The results of the verification sampling were used to make reclassification decisions for the 100-N-25 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

In accordance with this evaluation, the verification sampling results and modeling support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives (RAOs) and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (DOE-RL 2006b), and the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The sample and modeling results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The 100-N-25 waste site was excavated to a depth of approximately 4 m (13 ft) below ground surface. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Table ES-1. Summary of Remedial Action Goals for the 100-N-25 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not identified as COPCs for this site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (1.9×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for individual carcinogens is $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk (6.2×10^{-7}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not identified as COPCs for this site.	NA
	Attain National Primary Drinking Water Regulations [a]: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ.		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 30 µg/L (21.2 pCi/L) [c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene exceed soil RAGs for groundwater and/or river protection. However, based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years [d].	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).

[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).

[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

[d] Because the soil-partitioning coefficient values for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are greater than 80 mL/g (360 mL/g, 5,500 mL/g, 880 mL/g, 2,020 mL/g, and 3,470 mL/g, respectively), RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b) predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 100-N-25 excavation is approximately 17 m (55.8 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 4.4 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are predicted to be protective of groundwater and the Columbia River.

COPC = contaminant of potential concern
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan*
RESRAD = RESidual RADioactivity (dose model)

Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the 100-N Area ROD, a comparison against ecological risk screening levels has been made for the 100-N-25 waste site contaminants of potential concern and other constituents (Appendix A). Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for boron and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-25, FRENCH DRAIN 1 LIQUID WASTE SITE

STATEMENT OF PROTECTIVENESS

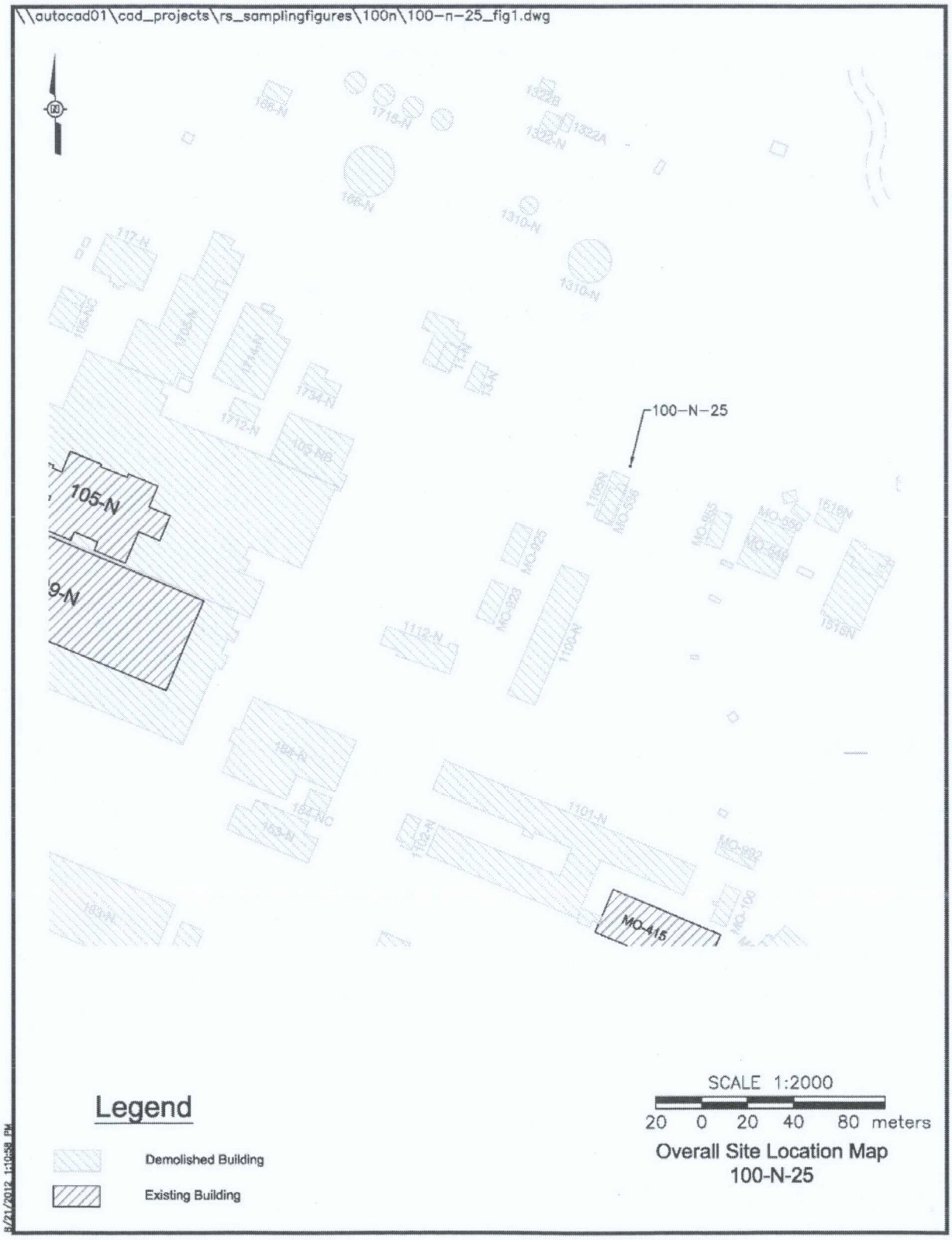
The 100-N-25, French Drain 1 Liquid Waste Site verification sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (RDR/RAWP) (DOE-RL 2006b) and the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999). The results of verification sampling and modeling show that residual soil concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The 100-N-25 waste site was excavated to a depth of approximately 4 m (13 ft) below ground surface. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the 100-N Area ROD, a comparison against ecological risk screening levels has been made for the 100-N-25 waste site contaminants of potential concern (COPCs) and other constituents (Appendix A). Ecological screening levels from *Washington Administrative Code* (WAC) 173-340 were exceeded for boron and vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-N-25, French Drain 1 Liquid Waste Site, part of the 100-NR-1 Operable Unit, is located approximately 82 m (270 ft) south of the location of the former 116-N-2, 1310-N Chemical Waste Storage Tank (Figure 1). The purpose of the french drain is unknown; however, the nearest structure was the 1105-N Administrative Office Trailer, which existed from 1975 to 1986. No above- or below-grade pipelines were found to have led to the drain; therefore, it was speculated that the drain was used for water runoff from the nearby office trailer roof or condensate from an air conditioning unit.

Figure 1. The 100-N-25 Waste Site Location Map.



REMEDIAL ACTION SUMMARY

Prior to the start of the 100-N-25 waste site remediation, water hydrant 32 was moved from the west side of the waste site to the east side. The move was conducted on March 16, 2012.

Remedial action at the 100-N-25 waste site was performed between March 27 and 29, 2012. The excavation continued to an approximate depth of 4 m (13 ft) below ground surface resulting in approximately 333 bank cubic meters (436 bank cubic yards) of material removed for disposal at the Environmental Restoration Disposal Facility (ERDF). There was no evidence of a french drain. A small section of steel piping associated with the water hydrant that was moved was removed and disposed at the ERDF. No anomalous materials were encountered during the excavation. All material was direct loaded from the excavation into trucks for disposal at the ERDF. No overburden piles or waste staging pile areas are associated with the 100-N-25 waste site. The post-excavation civil survey is shown in Figure 2.

A site visit was performed on April 18, 2012, to observe the remediated 100-N-25 waste site. Figure 3 is a post-remediation photograph of the site.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling was conducted at the 100-N-25 waste site on July 24, 2012. Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100-N Area RDR/RAWP (DOE-RL 2006b) and 100-N Area ROD (EPA 1999).

The verification sample results are provided in Appendix B and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 100-N-25 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. The statistical results of verification sampling are also summarized to support interim closure of the site. A more detailed discussion of the verification sampling can be found in the *Work Instruction for Verification Sampling of the 100-N-25, French Drain 1 Liquid Waste Site* (WCH 2012b).

Contaminants of Potential Concern

The COPCs for the 100-N-25 waste site were determined based upon available historical information. The Waste Information Data System and Stewardship Information System reports indicate the purpose of the drain is unknown. The nearest structure was the 1105-N Administrative Office Trailer, which existed from 1975 to 1986, and was located approximately 4.7 m (15.5 ft) south of the french drain. No above- or below-grade pipelines were found to have led to the drain; therefore, it is speculated that the drain was used for water runoff from the nearby office trailer roof or condensate from an air conditioning unit.

Figure 2. The 100-N-25 Post-Excavation Civil Survey.

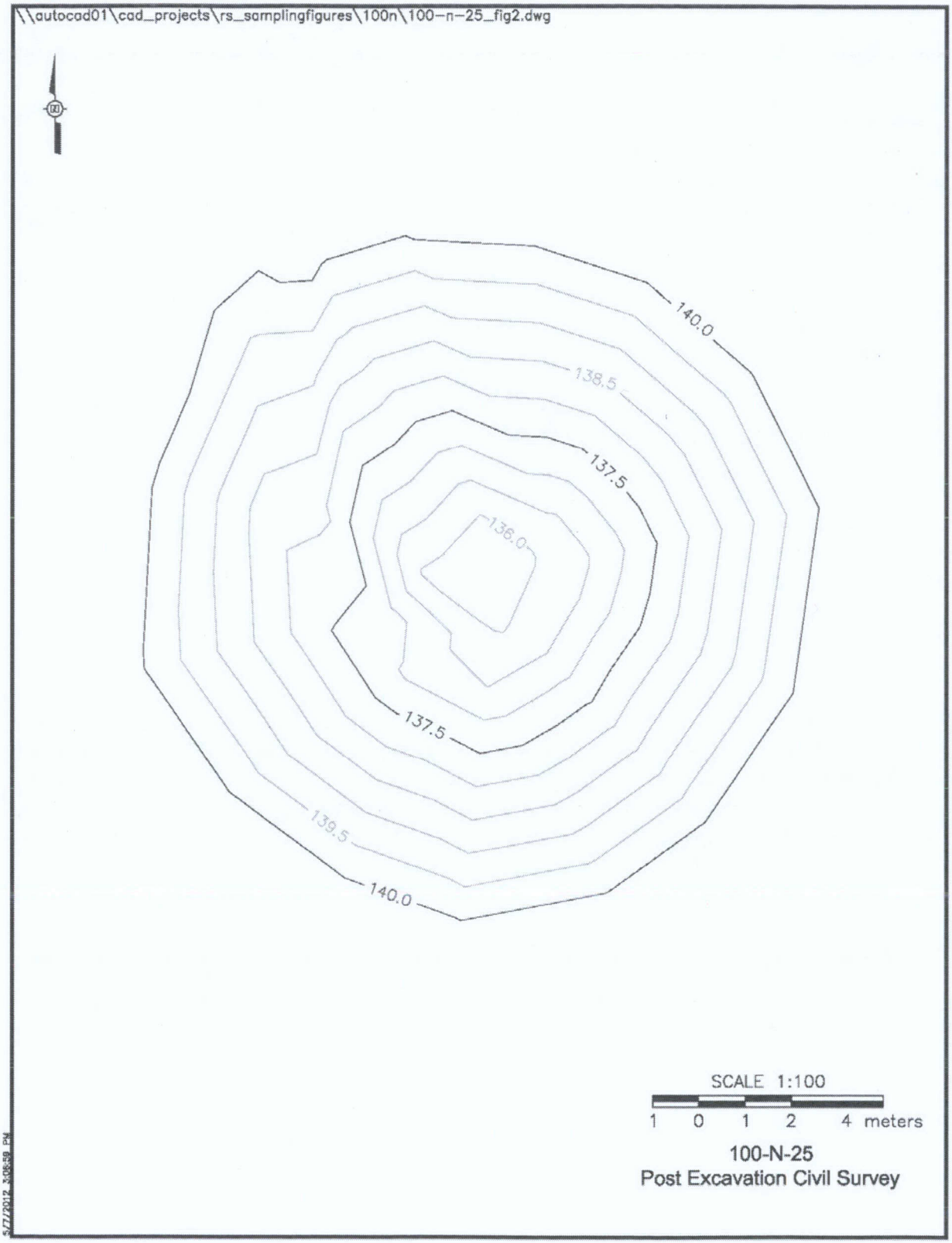


Figure 3. Post-Remediation Photograph of the 100-N-25 Waste Site (April 18, 2012).

The COPC list included the expanded list of inductively coupled plasma (ICP) metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium [total] cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc) and mercury. In-process soil samples collected from the site following remediation detected total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH); therefore, they were included as site COPCs. Nitrate was added as a COPC because of the nitrate contamination in the groundwater at the 100-N Area. To preclude holding time issues associated with ion chromatography (IC) anions EPA method 300.0 for nitrates, EPA method 353.2 was identified in the verification work instruction as the preferred analytical method for nitrates. However, the IC anions EPA method 300.0 analysis was inadvertently added to the chain of custody; therefore the reported results are included as part of the data set provided in Appendix B. Bromide, chloride, fluoride, nitrite, phosphate, and sulfate are not considered COPCs for this site.

The analytical methods that were performed to evaluate the site COPCs are provided in Table 1.

Table 1. Laboratory Analytical Methods.

Analytical Method	Contaminant of Potential Concern
ICP metals [a] – EPA Method 6010	Metals
Mercury – EPA Method 7471	Mercury
IC anions – EPA Method 300.0 [b]	Nitrate
NO_2/NO_3 – EPA Method 353.2	Nitrate
PAH – EPA Method 8310	Polycyclic aromatic hydrocarbons
TPH – EPA Method NWTPH-Dx	Total petroleum hydrocarbons

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[b] The IC anions analysis by EPA method 300.0 was not required by the work instruction (WCH 2012b) and was inadvertently added to the chain of custody during sampling.

EPA = U.S. Environmental Protection Agency
IC = ion chromatography
ICP = inductively coupled plasma
NWTPH-Dx = Northwest total petroleum hydrocarbons-diesel range organics
PAH = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons

Verification Sample Design

The 100-N-25 waste site consisted of a single decision unit, the excavation footprint, for verification sampling. Twelve statistical verification soil samples and a duplicate were collected from the excavation footprint. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (DOE-RL 2006a). All samples were grab samples collected at the predetermined coordinates. Additional information related to verification sampling can be found in the field sampling logbook (WCH 2012a). The verification sample summary is provided in Table 2. Figure 4 shows the waste site footprint and the sampling locations.

Verification Sample Results

All verification samples were analyzed using EPA-approved analytical methods. Evaluation of the verification data from the 100-N-25 excavation was performed by direct comparison of the statistical or maximum sample results for each COPC against the cleanup criteria.

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each detected COPC are computed for the 100-N-25 excavation decision unit as specified by the 100-N Area RDR/RAWP (DOE-RL 2006b). The calculations are provided in Appendix B. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for a decision unit, the maximum detected value was used for comparison to RAGs. If no detections for a given COPC were reported in the data set, then no statistical calculation or evaluation was performed for that COPC.

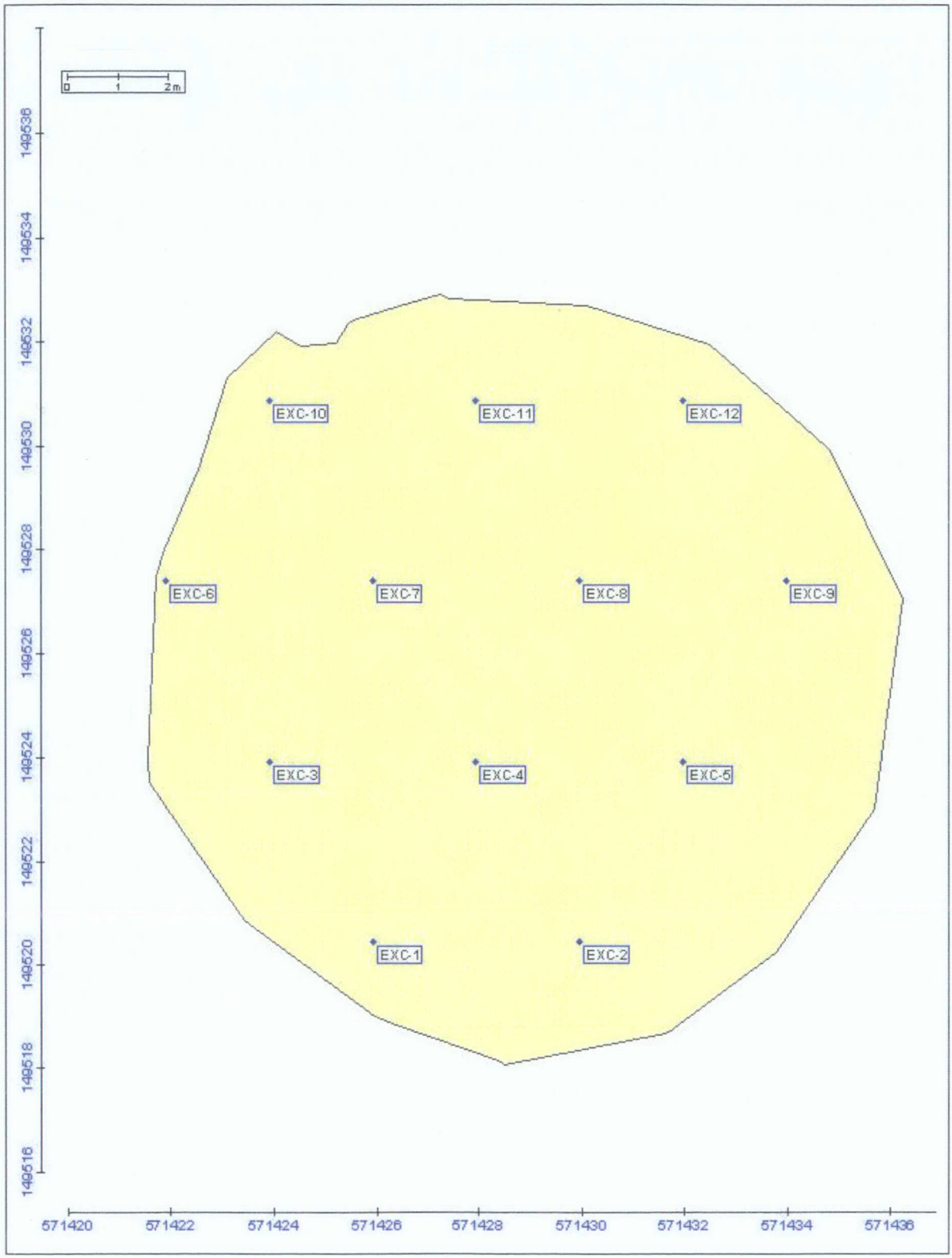
Table 2. 100-N-25 Waste Site Verification Sample Summary Table.

Sample Location	HEIS Sample Number	WSP Northing (m)	WSP Easting (m)	Sample Analysis [a]
EXC-1	J1PVN7	149520.4	571425.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-2	J1PVN8	149520.4	571430.0	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-3	J1PVN9	149523.9	571423.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-4	J1PVP0	149523.9	571427.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-5	J1PVP1	149523.9	571432.0	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-6	J1PVP2	149527.4	571421.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-7	J1PVP3	149527.4	571425.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-8	J1PVP4	149527.4	571430.0	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-9	J1PVP5	149527.4	571434.0	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-10	J1PVP6	149530.9	571423.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-11	J1PVP7	149530.9	571427.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
EXC-12	J1PVP8	149530.9	571432.0	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
Duplicate of EX-4	J1PVP9	149523.9	571427.9	ICP metals [b], mercury, NO_2/NO_3, IC anions [c], PAH, TPH
Equipment blank	J1PVR0	NA	NA	ICP metals [b], mercury

[a] Full protocol laboratory sample analysis was performed as defined in Table 1.
[b] Analysis for the expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[c] The IC anions analysis by EPA method 300.0 was inadvertently added to the chain of custody. Bromide, chloride, fluoride, nitrite, phosphate, and sulfate are not considered contaminants of potential concern for this site.

EPA = U.S. Environmental Protection Agency
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
IC = ion chromatography
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons – diesel range organics
WSP = Washington State Plane

Figure 4. Verification Sample Locations for the 100-N-25 Waste Site Excavation.



Comparisons of the results for each COPC from the 100-N-25 excavation against the RAGs are summarized in Table 3. Contaminants that were not detected by laboratory analysis are excluded from the table. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2012) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included the table. The complete laboratory results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to archival in Hanford Environmental Information System (HEIS), and are presented in Attachment 1 of the 95% UCL calculations (Appendix B).

Table 3. Comparison of Statistical Sample Contaminant Concentrations to Remedial Action Goals for the 100-N-25 Waste Site Verification Sampling Data. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [c]	1.0 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	2.0 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	62.0 (<BG)	16,000	200	400	No	--
Beryllium	0.19 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	1.4	16,000	320	-- [g]	No	--
Cadmium [c]	0.14 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium	9.8 (<BG)	120,000	18.5 [d]	18.5 [d]	No	--
Cobalt	9.3 (<BG)	1,600	32	-- [g]	No	--
Copper	16.5 (<BG)	2,960	59.2	22.0 [d]	No	--
Lead	5.6 (<BG)	353	10.2 [d]	10.2 [d]	No	--
Manganese	329 (<BG)	11,200	512 [d]	NA	No	--
Molybdenum [f]	0.36	400	8	-- [g]	No	--
Nickel	11.6 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	62.7 (<BG)	560	85.1 [d]	-- [g]	No	--
Zinc	50.8 (<BG)	24,000	480	67.8 [d]	No	--
Chloride	23.4 (<BG)	--	25,000	-- [g]	No	--
Fluoride	0.83 (<BG)	4,800	96	400	No	--
Nitrogen in nitrate	23.7	128,000	1,000	2,000	No	--
Nitrogen in nitrite and nitrate	103	128,000	1,000	2,000	No	--
Sulfate	28.8 (<BG)	--	25,000	-- [g]	No	--
TPH – diesel range	7.157	NA	200	200	No	--
TPH – diesel range (extended)	14.657	NA	200	200	No	--
Acenaphthene	0.022	4,800	96	129	No	--
Anthracene	0.027	24,000	240	1,920	No	--
Benzo(a)anthracene	0.047	1.37	0.015 [h]	0.015 [h]	Yes	Yes [i]

Table 3. Comparison of Statistical Sample Contaminant Concentrations to Remedial Action Goals for the 100-N-25 Waste Site Verification Sampling Data. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Benzo(a)pyrene	0.040	0.137	0.015 [h]	0.015 [h]	Yes	Yes [i]
Benzo(b)fluoranthene	0.049	1.37	0.015 [h]	0.015 [h]	Yes	Yes [i]
Benzo(ghi)perylene [j]	0.057	2,400	48	192	No	--
Benzo(k)fluoranthene	0.018	13.7	0.12	0.015 [h]	Yes	Yes [i]
Chrysene	0.056	137	1.2	0.10 [h]	No	--
Dibenz(a,h)anthracene	0.029	0.137	0.03 [h]	0.03 [h]	No	--
Fluoranthene	0.086	3,200	64	18.0	No	--
Fluorene	0.018	3,200	64	260	No	--
Indeno(1,2,3-cd)pyrene	0.067	1.37	0.015 [h]	0.015 [h]	Yes	Yes [i]
Phenanthrene [j]	0.094	24,000	240	1,920	No	--
Pyrene	0.093	2,400	48	192	No	--

[a] Remedial action goals obtained from the 100-N Area RDR/RAWP (DOE-RL 2006b).

[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-N-25 Waste Site Cleanup Verification 95% UCL Calculation* (Appendix B).

[c] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d), (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.12.1 of the 100-N Area RDR/RAWP (DOE-RL 2006b).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[f] No Hanford Site-specific or Washington State background value available.

[g] No parameters (bioconcentration factors or AWQC values) are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).

[h] Where cleanup levels are less than the RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses.

[i] Because the soil-partitioning coefficient values for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are greater than 80 mL/g (360 mL/g, 5,500 mL/g, 880 mL/g, 2,020 mL/g, and 3,470 mL/g, respectively), RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b) predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 100-N-25 excavation is approximately 17 m (55.8 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 4.4 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are predicted to be protective of groundwater and the Columbia River.

[j] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
Contaminant: benzo(ghi)perylene; surrogate: pyrene
Contaminant: phenanthrene; surrogate: anthracene

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
NA = not available
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan*
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 100-N-25 waste site achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the 100-N Area ROD (EPA 1999) and documented in the RDR/RAWP (DOE-RL 2006b).

Attainment of Nonradionuclide RAGS

Table 3 compares the verification sample values to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. Evaluation of the results indicates that residual concentrations of all COPCs are below the direct exposure soil RAGs for the 100-N-25 excavation. All COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene. Because the soil-partitioning coefficient values for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene are greater than 80 mL/g (360 mL/g, 5,500 mL/g, 880 mL/g, 2,020 mL/g, and 3,470 mL/g, respectively), RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b) predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 100-N-25 excavation is approximately 17 m (55.8 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 4.4 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are predicted to be protective of groundwater (and thus the Columbia River).

Three-Part Test for Nonradionuclides

A RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test, which consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection shall exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set.

The application of the three-part test for the 100-N-25 waste site excavation is included in the statistical calculations, where half or more of the data set was detected (Appendix B). The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs, with the exception of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene, which fail one or more parts of the three-part test. However, because the soil-partitioning coefficient values for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene are greater than 80 mL/g (360 mL/g, 5,500 mL/g, 880 mL/g, 2,020 mL/g, and 200 mL/g respectively), RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b) predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 100-N-25 excavation is approximately 17 m (55.8 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 4.4 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years.

Therefore, residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene are predicted to be protective of groundwater (and thus the Columbia River).

An additional application of the three-part test is included for the statistical data sets that default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs with the exception of indeno(1,2,3-cd)pyrene which fail all three parts of the three-part test. However, because the soil-partitioning coefficient value for indeno(1,2,3-cd)pyrene (3,470 mL/g) is greater than 80 mL/g, RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2006b) predicts the contaminant will not reach groundwater within 1,000 years. As stated above, the vadose zone beneath the 100-N-25 excavation is approximately 17 m (55.8 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 4.4 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of indeno(1,2,3-cd)pyrene is predicted to be protective of groundwater (and thus the Columbia River).

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 100-N-25 waste site, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 1.9×10^{-3}. The individual carcinogenic risk values for the carcinogenic constituents detected above background are less than 1×10^{-6}, and the cumulative carcinogenic risk value was 6.2×10^{-7}, which is less than 1×10^{-5}. The 100-N-25 waste site meets the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the 100-N Area RDR/RAWP (DOE-RL 2006b).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 100-N-25 waste site included calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. In addition, the distribution coefficients for these contaminants must be less than that necessary to show no migration to groundwater in 1,000 years based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b). Based on this model and a vadose zone of approximately 17 m (55.8 ft) in thickness, a distribution coefficient (K_d) of 4.4 or greater is required to show no

predicted migration to groundwater in 1,000 years. All individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 100-N-25 waste site is 1.1×10^{-1}, which is less than 1.0. No carcinogenic constituents from groundwater met the criteria for evaluation at the 100-N-25 waste site; therefore, no calculations of excess carcinogenic risk were performed. Therefore, nonradionuclide risk requirements related to groundwater are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2012b), the field logbook (WCH 2012a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 100-N-25 waste site established that the data are of the right type, quality, and quantity to support site closeout decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the ENRE project-specific database for data evaluation prior to archival in the HEIS and are summarized in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 100-N-25 waste site has been evaluated in accordance with the 100-N Area ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2006). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at the site meet the RAOs for direct exposure, groundwater protection, and river protection.

In accordance with this evaluation, the verification sampling results support a reclassification of the 100-N-25 waste site to interim closed out. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

BHI, 2001, *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* as amended, U.S. Department of Energy, Washington, D.C.

DOE-RL, 2006a, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites,* DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2006b, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area,* DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.

Ecology, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code* (WAC) 173-340, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2012, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

ENV-1, *Environmental Monitoring & Management*, Washington Closure Hanford, Richland, Washington.

EPA, 1989, *Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A; Interim Final*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999, *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

WAC 173-340, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code.*

WCH 2012a, *100-N Field Remediation and Sampling*, Logbook EL-1652-06, pp. 67-69, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *Work Instruction for Verification Sampling of the 100-N-25, French Drain 1 Liquid Waste Site,* 0100N-WI-G0046, Rev. 0, Washington Closure Hanford, Richland, Washington.

WDOH, 1997, *Hanford Guidance for Radiological Cleanup*, WDOH/320-015, Rev. 1, Washington State Department of Health, Olympia, Washington.

APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-N-25 Waste Site [a].

Hazardous Substance		2001 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Maximum Result
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
	Background	Metals (mg/kg)							
Antimony	5	5	NA	NA	NA	78	NA	0.27	1.0 (<BG)
Boron	NA	0.5	NA	NA	NA	NA	NA	NA	1.4
Manganese	512	1,100 [d]	NA	1,500	220	450	4,300	4,000	329 (<BG)
Vanadium	85.1	2	NA	NA	NA	NA	7.8	280	62.7 (<BG)
Zinc	67.8	86 [d]	200	360	160	120	46	79	50.8 (<BG)

NOTE: Shaded cells indicate screening values that are exceeded.

[a] Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceedances must be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the river corridor portion of the Hanford Site, which will include a more complete quantitative ecological risk assessment.

[b] Available on the Internet at www.epa.gov/ecotox/ecossl.

[c] Wildlife.

[d] Benchmark replaced by Washington state natural background concentration from Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication 94-115, Washington State Department of Ecology, Olympia, Washington.

BG = background
EPA = U.S. Environmental Protection Agency
NA = not available
WAC = *Washington Administrative Code*

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATION BRIEF

The calculations provided in this appendix are copies of originals that are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the file will be stored in a U.S. Department of Energy, Richland Operations Office, repository. These calculations has been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculation," Washington Closure Hanford, Richland, Washington. The calculations provided in this appendix include:

100-N-25 Waste Site Cleanup Verification 95% UCL Calculation, 0100N-CA-V0151, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-N-25 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100N-CA-V0152, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-N-25 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100N-CA-V0153, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

The calculations that are provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

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CALCULATION COVER SHEET

Project Title: 100-N Field Remediation **Job No. 14655**

Area: 100-N

Discipline: Environmental *Calculation No: 0100N-CA-V0151

Subject: 100-N-25 Waste Site Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 13 Attm. 1 = 4 Total = 18	J. D. Skoglie	C. H. Dobie	N. K. Schiffern	D. F. Obenauer	12/20/12

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie Date 10/15/12 Calc. No. 0100N-CA-V0151 Rev. No. 0
Project 100-N Field Remediation Job No. 14655 Checked C. H. Dobie Date 10/15/12
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations Sheet No. 1 of 13

Summary

Purpose:
Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) Model Toxics Control Act (MTCA) 3-part test for nonradionuclide analytes and calculate the relative percent difference (RPD) for primary-duplicate sample pairs for each contaminant of concern (COC) and contaminant of potential concern (COPC), as necessary.

Table of Contents:

Given/References:
1) Sample Results (Attachment 1).
2) DOE-RL, 2006a, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites*, DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) DOE-RL, 2006b, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area*, DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
5) Ecology, 1993, *Statistical Guidance for Ecology Site Managers*, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets), Publication #92-54, Washington Department of Ecology, Olympia, Washington.
6) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
7) EPA, 1989, Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A; Interim Final, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D. C.
8) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," Washington Administrative Code.

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2006b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 100-N-25 waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2006b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
The 100-N-25 waste site underwent statistical sampling at one decision unit; excavation area.

Analytical results for all sampling locations are summarized in the tables provided on sheet 4. Further information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie Date 10/15/12 Calc. No. 0100N-CA-V0151 Rev. No. 0
Project 100-N Field Remediation Job No. 14655 Checked C. H. Dobie Date 10/15/12
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations Sheet No. 2 of 13

Summary (continued)

Methodology, continued:

For nonradioactive analytes with ≤50% of the data below detection limits, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set (which includes primary and duplicate samples) is used instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported detections. Calculated cleanup levels are not available in (Ecology 2011) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COCs/COPCs and are also not included in these calculations.

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above. For radionuclide data, calculation of the statistics is done using the reported value. In cases where the laboratory does not report a value below the minimum detectable activity (MDA), half of the MDA is used in the calculation. For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets ($n < 10$), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2006b) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data set treated as uncensored.

The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
1) the 95% UCL exceeds the most stringent cleanup limit for each COPC/COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC,
3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COPC/COC.

The RPD is calculated when both the primary value and either the duplicate or split value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table 2-1 of the SAP (DOE-RL 2006a) for certain constituents. All other constituents will have their own pre-determined TDL's based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

$$RPD = [\,|M-S|/((M+S)/2)]^{*}100$$

where, M = Main Sample Value S = Split (or duplicate) Sample Value

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. To assist in the identification of anomalous sample pairs, when an analyte is detected in the primary or duplicate/split sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate/split result exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie		**Date** 09/12/12	**Calc. No.** 0100N-CA-V0151		**Rev. No.** 0
Project 100-N Field Remediation		**Job No.** 14655	**Checked** C. H. Dobie		**Date** 09/12/12
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations					**Sheet No.** 3 of 13

Summary (continued)

QUALIFIER LIST

B = estimated result. Result is less than the RL, but greater than MDL.
C = analyte was detected in both the sample and the associated QC blank, and the sample concentration was ≤5X the blank concentration.
J = estimate
M = sample duplicate precision not met
N = recovery exceeds upper or lower control limits.
U = undetected
X = more than 40% difference between columns, lower result reported (organics).
X = serial dilution in the analytical batch indicates that physical and chemical interferences are present (metals).

ACRONYM LIST

-- = not applicable
DE = direct exposure
GW = groundwater
MTCA = *Model Toxics Control Act*
PAH = polycyclic aromatic hydrocarbons
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford

CALCULATION SHEET

Originator J. D. Skoglie Date 10/15/12 Calc. No. 0100N-CA-V0151 Rev. No. 0
Project 100-N Field Remediation Job No. 14655 Checked C. H. Dobie Date 10/15/12
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations Sheet No. 4 of 13

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the excavation, staging pile area, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

Results Summary - Excavation Area

Analyte	EXC		Units
	95% UCL Result	Maximum Result	
Antimony	1.0	--	mg/kg
Arsenic	2.0	--	mg/kg
Barium	62.0	--	mg/kg
Beryllium	0.19	--	mg/kg
Boron	1.4	--	mg/kg
Cadmium	0.14	--	mg/kg
Chromium	9.8	--	mg/kg
Cobalt	9.3	--	mg/kg
Copper	16.5	--	mg/kg
Lead	5.6	--	mg/kg
Manganese	329	--	mg/kg
Molybdenum	--	0.36	mg/kg
Nickel	11.6	--	mg/kg
Vanadium	62.7	--	mg/kg
Zinc	50.8	--	mg/kg
Chloride	23.4	--	mg/kg
Fluoride	0.83	--	mg/kg
Nitrogen in nitrate	23.7	--	mg/kg
Nitrogen in nitrate and nitrite	103	--	mg/kg
Sulfate	28.8	--	mg/kg
TPH - diesel range	7157	--	ug/kg
TPH - diesel range EXT	14657	--	ug/kg
Acenaphthene	--	22	ug/kg
Anthracene	--	27	ug/kg
Benzo(a)anthracene	47	--	ug/kg
Benzo(a)pyrene	40	--	ug/kg
Benzo(b)fluoranthene	49	--	ug/kg
Benzo(ghi)perylene	--	57	ug/kg
Benzo(k)fluoranthene	18	--	ug/kg
Chrysene	56	--	ug/kg
Dibenz(a,h)anthracene	--	29	ug/kg
Fluoranthene	86	--	ug/kg
Fluorene	--	18	ug/kg
Indeno(1,2,3-cd)pyrene	--	67	ug/kg
Phenanthrene	--	94	ug/kg
Pyrene	93	--	ug/kg

3-Part Test Evaluation:

	EXC	
95% UCL or maximum* > Cleanup Limit?	YES	YES
> 10% above Cleanup Limit?	YES	YES
Any sample > 2x Cleanup Limit?	YES	YES

*The 95% UCL result or maximum value, depending on data censorship, as described in the methodology section.

Relative Percent Difference Results and QA/QC Analysis*

Analyte	Duplicate Analysis
	EXC
Aluminum	1.7%
Barium	3.1%
Calcium	9.4%
Chromium	6.2%
Copper	3.7%
Iron	1.4%
Magnesium	5.0%
Manganese	2.5%
Silicon	4.0%
Sodium	19.7%
Vanadium	3.5%
Zinc	2.3%

*RPD listed where result produced, based on criteria. If RPD not required, no value is listed. The significance of the reported RPD values, including values greater than 30%, is addressed in the data quality assessment section of the RSVP.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations

Date 10/15/12
Job No. 14655

Calc. No. 0100N-CA-V0151
Checked C. H. Dobie

Rev. No. 0
Date 10/15/12
Sheet No. 5 of 13

100-N-25 Statistical Calculations

Verification Data -Excavation (EXC)

Sample Area	Sample Number	Sample Date	Antimony mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Lead mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	0.85	J	0.36	2.4		0.62	58.9	X	0.071	0.23		0.031	1.1	B	0.92	0.12	B	0.038	8.3	X	0.054	8.5	X	0.094	16.1		0.20	4.6		0.25
Duplicate of J1PVP0	J1PVP9	7/24/12	0.72	J	0.37	1.9		0.64	57.1	X	0.074	0.19		0.032	0.95	U	0.95	0.11	B	0.040	7.8	X	0.056	8.4	X	0.097	16.7		0.21	4.5		0.26
EXC-1	J1PVN7	7/24/12	1.6	JM	0.38	1.8		0.66	80.2	X	0.076	0.22		0.033	1.8	B	0.99	0.15	B	0.041	13.6	X	0.058	8.5	X	0.10	15.5		0.22	4.8		0.27
EXC-2	J1PVN8	7/24/12	1.0	J	0.36	1.8		0.62	57.1	X	0.071	0.21		0.031	1.5	B	0.92	0.14	B	0.038	9.3	X	0.054	8.7	X	0.094	16.3		0.20	4.0		0.25
EXC-3	J1PVN9	7/24/12	0.63	J	0.38	1.6		0.65	58.0	X	0.075	0.14	B	0.033	1.0	B	0.97	0.13	B	0.041	6.7	X	0.058	9.1	X	0.099	15.7		0.22	5.2		0.27
EXC-5	J1PVP1	7/24/12	0.99	J	0.34	2.3		0.59	44.1	X	0.068	0.16	B	0.029	0.87	U	0.87	0.12	B	0.037	7.3	X	0.052	8.4	X	0.089	14.1		0.19	4.1		0.24
EXC-6	J1PVP2	7/24/12	1.0	J	0.33	1.0		0.58	54.6	X	0.066	0.14	U	0.14	0.86	U	0.86	0.12	B	0.036	8.1	X	0.051	11.1	X	0.44	17.6		0.95	6.7		1.2
EXC-7	J1PVP3	7/24/12	0.64	J	0.32	1.9		0.56	61.2	X	0.065	0.19		0.028	1.1	B	0.83	0.14	B	0.035	10.0	X	0.049	8.7	X	0.085	15.9		0.18	6.7		0.23
EXC-8	J1PVP4	7/24/12	0.89	J	0.35	2.6		0.61	49.1	X	0.070	0.25		0.031	0.91	U	0.91	0.10	B	0.038	8.6	X	0.054	9.4	X	0.093	16.3		0.20	5.9		0.25
EXC-9	J1PVP5	7/24/12	0.66	J	0.37	1.7		0.65	54.7	X	0.075	0.14	B	0.033	1.6	B	0.97	0.14	B	0.040	7.7	X	0.057	8.9	X	0.099	14.1		0.21	4.3		0.27
EXC-10	J1PVP6	7/24/12	0.52	JB	0.37	1.8		0.65	63.8	X	0.074	0.16	B	0.032	1.0	B	0.96	0.12	B	0.040	9.6	X	0.057	7.9	X	0.098	15.3		0.21	6.0		0.26
EXC-11	J1PVP7	7/24/12	0.68	J	0.37	1.9		0.64	49.1	X	0.074	0.15	B	0.032	0.96	B	0.96	0.12	B	0.040	9.1	X	0.057	9.1	X	0.098	17.6		0.21	3.9		0.26
EXC-12	J1PVP8	7/24/12	0.73	J	0.35	0.99		0.61	54.8	X	0.070	0.13	B	0.031	0.91	U	0.91	0.14	B	0.038	7.7	X	0.054	8.9	X	0.093	15.4		0.20	4.3		0.25

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Lead mg/kg
EXC-4	J1PVP0/ J1PVP9	7/24/12	0.79	2.2	58.0	0.21	0.79	0.12	8.1	8.5	16.4	4.6
EXC-1	J1PVN7	7/24/12	1.6	1.8	80.2	0.22	1.8	0.15	13.6	8.5	15.5	4.8
EXC-2	J1PVN8	7/24/12	1.0	1.8	57.1	0.21	1.5	0.14	9.3	8.7	16.3	4.0
EXC-3	J1PVN9	7/24/12	0.63	1.6	58.0	0.14	1.0	0.13	6.7	9.1	15.7	5.2
EXC-5	J1PVP1	7/24/12	0.99	2.3	44.1	0.16	0.44	0.12	7.3	8.4	14.1	4.1
EXC-6	J1PVP2	7/24/12	1.0	1.0	54.6	0.070	0.43	0.12	8.1	11.1	17.6	6.7
EXC-7	J1PVP3	7/24/12	0.64	1.9	61.2	0.19	1.1	0.14	10.0	8.7	15.9	6.7
EXC-8	J1PVP4	7/24/12	0.89	2.6	49.1	0.25	0.46	0.10	8.6	9.4	16.3	5.9
EXC-9	J1PVP5	7/24/12	0.66	1.7	54.7	0.14	1.6	0.14	7.7	8.9	14.1	4.3
EXC-10	J1PVP6	7/24/12	0.52	1.8	63.8	0.16	1.0	0.12	9.6	7.9	15.3	6.0
EXC-11	J1PVP7	7/24/12	0.68	1.9	49.1	0.15	0.96	0.12	9.1	9.1	17.6	3.9
EXC-12	J1PVP8	7/24/12	0.73	0.99	54.8	0.13	0.46	0.14	7.7	8.9	15.4	4.3

Statistical Computations

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	8%	33%	0%	0%	0%	0%	0%
Mean	0.84	1.8	57.1	0.17	0.96	0.13	8.8	8.9	15.9	5.0
Standard deviation	0.29	0.46	9.1	0.049	0.48	0.014	1.8	0.79	1.1	1.0
95% UCL on mean	1.0	2.0	62.0	0.19	1.4	0.14	9.8	9.3	16.5	5.6
Maximum value	1.6	2.6	80.2	0.25	1.8	0.15	13.6	11.1	17.6	6.7
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	5 GW & River Protection	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	32 GW Protection	22.0 River Protection	10.2 GW & River Protection
WAC 173-340 3-PART TEST										
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.

Qualifiers are defined on sheet 3

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations

Date 10/15/12
Job No. 14655

Calc. No. 0100N-CA-V0151
Checked C. H. Dobie

Rev. No. 0
Date 10/15/12
Sheet No. 6 of 13

100-N-25 Statistical Calculations
Verification Data -Excavation (EXC)

Sample Area	Sample Number	Sample Date	Manganese mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL	Chloride mg/kg	Q	PQL	Fluoride mg/kg	Q	PQL	Nitrogen in Nitrate mg/kg	Q	PQL	Nitrogen in Nitrite and Nitrate mg/kg	Q	PQL	Sulfate mg/kg	Q	PQL	TPH - Diesel Range ug/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	322	X	0.094	10.3	X	0.12	53.5	X	0.088	44.3	X	0.37	3.2	B	1.9	0.99	B	0.81	2.5	J	0.31	2.3		0.29	7.5		1.7	2600	J	650
Duplicate of J1PVP0	J1PVP9	7/24/12	314	X	0.097	10.2	X	0.12	55.4	X	0.091	43.3	X	0.39	2.9	B	2.0	0.82	U	0.82	2.2	JB	0.31	2.0		0.29	7.3		1.7	2000	J	690
EXC-1	J1PVN7	7/24/12	347	X	0.10	10.9	X	0.12	54.6	X	0.095	53.7	X	0.40	3.5	B	2.0	0.85	U	0.85	1.5	JB	0.33	1.0	M	0.31	12.7		1.8	3900	J	700
EXC-2	J1PVN8	7/24/12	325	X	0.094	13.4	X	0.12	57.3	X	0.088	45.6	X	0.37	6.7		2.0	1.3	B	0.82	1.3	JB	0.31	0.88		0.30	15.8		1.7	870	J	640
EXC-3	J1PVN9	7/24/12	312	X	0.099	9.9	X	0.12	61.7	X	0.093	48.5	X	0.39	3.5	B	2.0	0.86	B	0.83	3.2	J	0.32	2.9		0.30	18.1		1.7	4300		670
EXC-5	J1PVP1	7/24/12	304	X	0.089	9.7	X	0.11	52.5	X	0.084	46.0	X	0.35	7.6		2.0	0.91	B	0.84	7.1	J	0.32	7.0		0.30	13.6		1.8	1100	J	680
EXC-6	J1PVP2	7/24/12	309	X	0.087	11.7	X	0.11	70.6	X	0.41	48.6	X	0.35	2.1	B	2.0	0.82	U	0.82	0.91	JB	0.31	0.29	U	0.29	3.7	B	1.7	5400		660
EXC-7	J1PVP3	7/24/12	327	X	0.085	11.3	X	0.10	59.7	X	0.080	47.3	X	0.34	5.4		1.9	1.0	B	0.81	8.1	J	0.31	8.2		0.29	15.1		1.7	3400	J	660
EXC-8	J1PVP4	7/24/12	358	X	0.093	13.3	X	0.11	60.3	X	0.087	48.5	X	0.37	6.4		2.0	0.85	U	0.85	15.0	J	0.32	16.5		0.31	30.8		1.8	1100	J	680
EXC-9	J1PVP5	7/24/12	316	X	0.099	10.3	X	0.12	62.8	X	0.093	61.1	X	0.39	83.9		2.0	0.84	U	0.84	2.9	J	0.32	2.9		0.30	8.3		1.8	3200	J	650
EXC-10	J1PVP6	7/24/12	311	X	0.098	10.1	X	0.12	57.2	X	0.092	46.9	X	0.39	10.3		1.9	0.94	B	0.81	10.2	J	0.31	11.0		0.30	19.6		1.7	6000		630
EXC-11	J1PVP7	7/24/12	317	X	0.098	10.8	X	0.12	66.1	X	0.092	46.2	X	0.39	16.3		2.0	0.83	U	0.83	26.8	J	0.32	27.4		0.30	35.9		1.7	2100	J	640
EXC-12	J1PVP8	7/24/12	304	X	0.093	9.0	X	0.11	61.4	X	0.087	47.0	X	0.37	2.0	B	1.9	0.81	U	0.81	0.59	JB	0.31	0.30	U	0.30	3.0	B	1.7	12000		620

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	Chloride mg/kg	Fluoride mg/kg	Nitrogen in Nitrate mg/kg	Nitrogen in Nitrite and Nitrate mg/kg	Sulfate mg/kg	TPH - Diesel Range ug/kg
EXC-4	J1PVP0/ J1PVP9	7/24/12	318	10.3	54.5	43.8	3.1	0.70	2.4	2.2	7.4	2300
EXC-1	J1PVN7	7/24/12	347	10.9	54.6	53.7	3.5	0.43	1.5	1.0	12.7	3900
EXC-2	J1PVN8	7/24/12	325	13.4	57.3	45.6	6.7	1.3	1.3	0.88	15.8	870
EXC-3	J1PVN9	7/24/12	312	9.9	61.7	48.5	3.5	0.86	3.2	2.9	18.1	4300
EXC-5	J1PVP1	7/24/12	304	9.7	52.5	46.0	7.6	0.91	7.1	7.0	13.6	1100
EXC-6	J1PVP2	7/24/12	309	11.7	70.6	48.6	2.1	0.41	0.91	0.15	3.7	5400
EXC-7	J1PVP3	7/24/12	327	11.3	59.7	47.3	5.4	1.0	8.1	8.2	15.1	3400
EXC-8	J1PVP4	7/24/12	358	13.3	60.3	48.5	6.4	0.43	15.0	16.5	30.8	1100
EXC-9	J1PVP5	7/24/12	316	10.3	62.8	61.1	83.9	0.42	2.9	2.9	8.3	3200
EXC-10	J1PVP6	7/24/12	311	10.1	57.2	46.9	10.3	0.94	10.2	11.0	19.6	6000
EXC-11	J1PVP7	7/24/12	317	10.8	66.1	46.2	16.3	0.42	26.8	27.4	35.9	2100
EXC-12	J1PVP8	7/24/12	304	9.0	61.4	47.0	2.0	0.41	0.59	0.15	3.0	12000

Statistical Computations

	Manganese	Nickel	Vanadium	Zinc	Chloride	Fluoride	Nitrogen in Nitrate	Nitrogen in Nitrite and Nitrate	Sulfate	TPH - Diesel Range
95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	50%	0%	17%	0%	0%
Mean	321	10.9	59.9	48.6	12.6	0.68	6.7	6.7	15.3	3806
Standard deviation	16.6	1.4	5.2	4.6	22.8	0.31	7.7	8.2	10.0	3071
95% UCL on mean	329	11.6	62.7	50.8	23.4	0.83	23.7	103	28.8	7157
Maximum value	358	13.4	70.6	61.1	83.9	1.3	26.8	27.4	35.9	12000
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless stated otherwise	512 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	25000 GW Protection	96 GW Protection	1000 GW Protection	1000 GW Protection	25000 GW Protection	200000 ug/kg GW & River Protection
WAC 173-340 3-PART TEST										
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NO	NO	NA	NO
> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NO	NO	NA	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NO	NO	NA	NO
WAC 173-340 Compliance?	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (100 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (2.81 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (237 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Qualifiers are defined on sheet 3

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations

Date 10/15/12
Job No. 14655

Calc. No. 0100N-CA-V0151
Checked C. H. Dobie

Rev. No. 0
Date 10/15/12
Sheet No. 7 of 13

100-N-25 Statistical Calculations
Verification Data -Excavation (EXC)

Sample Area	Sample Number	Sample Date	TPH - Diesel Range Extended ug/kg	Q	PQL	Benzo(a)anthracene ug/kg	Q	PQL	Benzo(a)pyrene ug/kg	Q	PQL	Benzo(b)fluoranthene ug/kg	Q	PQL	Benzo(k)fluoranthene ug/kg	Q	PQL	Chrysene ug/kg	Q	PQL	Fluoranthene ug/kg	Q	PQL	Pyrene ug/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	3300	J	960	3.1	U	3.1	6.2	U	6.2	4.1	U	4.1	3.8	U	3.8	4.7	U	4.7	13	U	13	12	U	12
Duplicate of J1PVP0	J1PVP9	7/24/12	2800	J	1000	3.1	U	3.1	6.2	U	6.2	4.0	U	4.0	3.8	U	3.8	4.6	U	4.6	12	U	12	12	U	12
EXC-1	J1PVN7	7/24/12	5000		1000	3.2	U	3.2	6.5	U	6.5	4.3	U	4.3	4.0	U	4.0	4.9	U	4.9	13	U	13	12	U	12
EXC-2	J1PVN8	7/24/12	950	U	950	3.1	U	3.1	6.2	U	6.2	4.1	U	4.1	3.8	U	3.8	4.7	U	4.7	13	U	13	12	U	12
EXC-3	J1PVN9	7/24/12	7000		980	110		3.3	80		6.6	90		4.3	31		4.1	110		5.0	180		13	180		12
EXC-5	J1PVP1	7/24/12	1500	J	1000	3.1	U	3.1	6.3	U	6.3	4.1	U	4.1	3.9	U	3.9	4.8	U	4.8	13	U	13	12	U	12
EXC-6	J1PVP2	7/24/12	8700		960	61		3.1	46		6.3	69		4.1	22		3.9	71		4.8	100		13	83		12
EXC-7	J1PVP3	7/24/12	5500		980	19	X	3.0	22		6.1	26		4.0	12	J	3.7	26	J	4.6	39		12	50		11
EXC-8	J1PVP4	7/24/12	1500	J	1000	3.2	U	3.2	6.5	U	6.5	4.3	U	4.3	4.0	U	4.0	4.9	U	4.9	13	U	13	12	U	12
EXC-9	J1PVP5	7/24/12	5600		960	7.5	J	3.0	8.7	JX	5.9	11	JX	3.9	6.4	J	3.7	9.8	J	4.5	18	J	12	15	J	11
EXC-10	J1PVP6	7/24/12	11000		930	110		3.0	100		5.9	120		3.9	46		3.6	140		4.5	210		12	250		11
EXC-11	J1PVP7	7/24/12	3100	J	940	5.0	JX	3.2	13	J	6.4	13	J	4.2	6.0	J	4.0	17	J	4.9	28	J	13	30	J	12
EXC-12	J1PVP8	7/24/12	14000		920	3.0	U	3.0	11	J	6.1	14	X	4.0	5.7	J	3.7	13	J	4.6	18	J	12	22	J	11

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	TPH - Diesel Range Extended ug/kg	Benzo(a)anthracene ug/kg	Benzo(a)pyrene ug/kg	Benzo(b)fluoranthene ug/kg	Benzo(k)fluoranthene ug/kg	Chrysene ug/kg	Fluoranthene ug/kg	Pyrene ug/kg
EXC-4	J1PVP0/ J1PVP9	7/24/12	3050	1.6	3.1	2.0	1.9	2.3	6.3	6.0
EXC-1	J1PVN7	7/24/12	5000	1.6	3.3	2.2	2.0	2.5	6.5	6.0
EXC-2	J1PVN8	7/24/12	475	1.6	3.1	2.1	1.9	2.4	6.5	6.0
EXC-3	J1PVN9	7/24/12	7000	110	80	90	31	110	180	180
EXC-5	J1PVP1	7/24/12	1500	1.6	3.2	2.1	2.0	2.4	6.5	6.0
EXC-6	J1PVP2	7/24/12	8700	61	46	69	22	71	100	83
EXC-7	J1PVP3	7/24/12	5500	19	22	26	12	26	39	50
EXC-8	J1PVP4	7/24/12	1500	1.6	3.3	2.2	2.0	2.5	6.5	6.0
EXC-9	J1PVP5	7/24/12	5600	7.5	8.7	11	6.4	9.8	18	15
EXC-10	J1PVP6	7/24/12	11000	110	100	120	46	140	210	250
EXC-11	J1PVP7	7/24/12	3100	5.0	13	13	6.0	17	28	30
EXC-12	J1PVP8	7/24/12	14000	1.5	11	14	5.7	13	18	22

Statistical Computations

	TPH - Diesel Range Extended	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Chrysene	Fluoranthene	Pyrene
95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12	12	12
% < Detection limit	8%	50%	42%	42%	42%	42%	42%	42%
Mean	5535	27	25	29	12	33	52	55
Standard deviation	4093	42	33	40	14	47	72	80
95% UCL on mean	14657	47	40	49	18	56	86	93
Maximum value	14000	110	100	120	46	140	210	250
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	200000 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg River Protection	100 ug/kg River Protection	18000 ug/kg River Protection	48000 ug/kg GW Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NO	YES	YES	YES	YES	NO	NO	NO
> 10% above Cleanup Limit?	NO	YES	YES	YES	YES	YES	NO	NO
Any sample > 2X Cleanup Limit?	NO	YES	YES	YES	YES	NO	NO	NO
WAC 173-340 Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Qualifiers are defined on sheet 3

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations

Date 10/15/12
Job No. 14655

Calc. No. 0100N-CA-V0151
Checked C. H. Dobie

Rev. No. 0
Date 10/15/12
Sheet No. 8 of 13

100-N-25 Maximum Calculations
Verification Data -Excavation (EXC)

Sample Area	Sample Number	Sample Date	Molybdenum mg/kg	Q	PQL	Acenaphthene ug/kg	Q	PQL	Anthracene ug/kg	Q	PQL	Benzo(ghi)perylene ug/kg	Q	PQL	Dibenz(a,h)anthracene ug/kg	Q	PQL	Fluorene ug/kg	Q	PQL	Indeno(1,2,3-cd)pyrene ug/kg	Q	PQL	Phenanthrene ug/kg	Q	PQL
EX-4	J1PVP0	7/24/12	0.24	U	0.24	9.7	U	9.7	2.9	U	2.9	7.0	U	7.0	11	U	11	5.1	U	5.1	12	U	12	12	U	12
Duplicate of J1PVP0	J1PVP9	7/24/12	0.25	U	0.25	9.6	U	9.6	2.9	U	2.9	6.9	U	6.9	11	U	11	5.1	U	5.1	12	U	12	12	U	12
EX-1	J1PVN7	7/24/12	0.36	B	0.26	10	U	10	3.1	U	3.1	7.3	U	7.3	11	U	11	5.4	U	5.4	12	U	12	12	U	12
EX-2	J1PVN8	7/24/12	0.33	B	0.24	9.6	U	9.6	2.9	U	2.9	6.9	U	6.9	11	U	11	5.1	U	5.1	12	U	12	12	U	12
EX-3	J1PVN9	7/24/12	0.26	U	0.26	17	JX	10	27		3.1	57		7.4	11	U	11	16	JX	5.4	52		12	88		12
EX-5	J1PVP1	7/24/12	0.23	U	0.23	9.8	U	9.8	3.0	U	3.0	7.1	U	7.1	11	U	11	5.2	U	5.2	12	U	12	12	U	12
EX-6	J1PVP2	7/24/12	0.23	U	0.23	9.9	U	9.9	11	J	3.0	39		7.1	11	U	11	8.8	J	5.2	40		12	31	J	12
EX-7	J1PVP3	7/24/12	0.22	U	0.22	9.5	U	9.5	2.9	U	2.9	18	J	6.8	10	U	10	5.0	U	5.0	15	J	11	11	U	11
EX-8	J1PVP4	7/24/12	0.24	U	0.24	10	U	10	3.1	U	3.1	7.3	U	7.3	11	U	11	5.4	U	5.4	12	U	12	12	U	12
EX-9	J1PVP5	7/24/12	0.26	U	0.26	9.3	U	9.3	2.8	U	2.8	6.7	U	6.7	10	U	10	4.9	U	4.9	11	U	11	11	U	11
EX-10	J1PVP6	7/24/12	0.25	U	0.25	22	JX	9.3	27		2.8	52	X	6.7	29		10	18	JX	4.9	67		11	94		11
EX-11	J1PVP7	7/24/12	0.25	U	0.25	10	U	10	3.1	U	3.1	7.2	U	7.2	11	U	11	5.3	U	5.3	12	U	12	12	J	12
EX-12	J1PVP8	7/24/12	0.24	U	0.24	9.5	U	9.5	2.9	U	2.9	9.1	J	6.9	10	U	10	5.0	U	5.0	11	U	11	11	U	11

Statistical Computations

	Molybdenum	Acenaphthene	Anthracene	Benzo(ghi)perylene	Dibenz(a,h)anthracene	Fluorene	Indeno(1,2,3-cd)pyrene	Phenanthrene
% < Detection limit	83%	83%	75%	58%	92%	75%	67%	67%
Maximum value	0.36	22	27	57	29	18	67	94
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	8 GW Protection	96000 ug/kg GW Protection	240000 ug/kg GW Protection	48000 ug/kg GW Protection	30 ug/kg GW & River Protection	64000 ug/kg GW Protection	15 ug/kg GW & River Protection	240000 ug/kg GW Protection
3-PART TEST								
Maximum > Cleanup Limit?	NO	NO	NO	NO	NO	NO	YES	NO
> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO	YES	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO	YES	NO
3-Part Test Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Qualifiers are defined on sheet 3

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations

Date 09/12/12
Job No. 14655

Calc. No. 0100N-CA-V0151
Checked C. H. Dobie

Rev. No. 0
Date 09/12/12
Sheet No. 9 of 13

Ecology Software (MTCAStat) Results, 100-N-25 Excavation (EXC)

Antimony 95% UCL Calculation

DATA	ID
0.79	J1PVP0/ J1PVP9
1.6	J1PVN7
1.0	J1PVN8
0.63	J1PVN9
0.99	J1PVP1
1.0	J1PVP2
0.64	J1PVP3
0.89	J1PVP4
0.66	J1PVP5
0.52	J1PVP6
0.68	J1PVP7
0.73	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.84
Censored		Lognormal mean	0.84
Detection limit or PQL		Std. devn.	0.29
Method detection limit		Median	0.76
TOTAL	12	Min.	0.52
		Max.	1.6

Lognormal distribution? Normal distribution?
r-squared is: 0.920 r-squared is: 0.815
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.0

Arsenic 95% UCL Calculation

DATA	ID
2.2	J1PVP0/ J1PVP9
1.8	J1PVN7
1.8	J1PVN8
1.6	J1PVN9
2.3	J1PVP1
1.0	J1PVP2
1.9	J1PVP3
2.6	J1PVP4
1.7	J1PVP5
1.8	J1PVP6
1.9	J1PVP7
0.99	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	1.8
Censored		Lognormal mean	1.8
Detection limit or PQL		Std. devn.	0.46
Method detection limit		Median	1.8
TOTAL	12	Min.	0.99
		Max.	2.6

Lognormal distribution? Normal distribution?
r-squared is: 0.860 r-squared is: 0.923
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 2.0

Barium 95% UCL Calculation

DATA	ID
58.0	J1PVP0/ J1PVP9
80.2	J1PVN7
57.1	J1PVN8
58.0	J1PVN9
44.1	J1PVP1
54.6	J1PVP2
61.2	J1PVP3
49.1	J1PVP4
54.7	J1PVP5
63.8	J1PVP6
49.1	J1PVP7
54.8	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	57.1
Censored		Lognormal mean	57.1
Detection limit or PQL		Std. devn.	9.1
Method detection limit		Median	56.0
TOTAL	12	Min.	44.1
		Max.	80.2

Lognormal distribution? Normal distribution?
r-squared is: 0.913 r-squared is: 0.862
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 62.0

Beryllium 95% UCL Calculation

DATA	ID
0.21	J1PVP0/ J1PVP9
0.22	J1PVN7
0.21	J1PVN8
0.14	J1PVN9
0.16	J1PVP1
0.070	J1PVP2
0.19	J1PVP3
0.25	J1PVP4
0.14	J1PVP5
0.16	J1PVP6
0.15	J1PVP7
0.13	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.17
Censored		Lognormal mean	0.17
Detection limit or PQL		Std. devn.	0.049
Method detection limit		Median	0.16
TOTAL	12	Min.	0.070
		Max.	0.25

Lognormal distribution? Normal distribution?
r-squared is: 0.876 r-squared is: 0.956
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.19

Boron 95% UCL Calculation

DATA	ID
0.79	J1PVP0/ J1PVP9
1.8	J1PVN7
1.5	J1PVN8
1.0	J1PVN9
0.44	J1PVP1
0.43	J1PVP2
1.1	J1PVP3
0.46	J1PVP4
1.6	J1PVP5
1.0	J1PVP6
0.96	J1PVP7
0.46	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.96
Censored		Lognormal mean	0.98
Detection limit or PQL		Std. devn.	0.48
Method detection limit		Median	0.98
TOTAL	12	Min.	0.43
		Max.	1.8

Lognormal distribution? Normal distribution?
r-squared is: 0.908 r-squared is: 0.917
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.4

Cadmium 95% UCL Calculation

DATA	ID
0.12	J1PVP0/ J1PVP9
0.15	J1PVN7
0.14	J1PVN8
0.13	J1PVN9
0.12	J1PVP1
0.12	J1PVP2
0.14	J1PVP3
0.10	J1PVP4
0.14	J1PVP5
0.12	J1PVP6
0.12	J1PVP7
0.14	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.13
Censored		Lognormal mean	0.13
Detection limit or PQL		Std. devn.	0.014
Method detection limit		Median	0.13
TOTAL	12	Min.	0.10
		Max.	0.15

Lognormal distribution? Normal distribution?
r-squared is: 0.906 r-squared is: 0.917
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.14

Chromium 95% UCL Calculation

DATA	ID
8.1	J1PVP0/ J1PVP9
13.6	J1PVN7
9.3	J1PVN8
6.7	J1PVN9
7.3	J1PVP1
8.1	J1PVP2
10.0	J1PVP3
8.6	J1PVP4
7.7	J1PVP5
9.6	J1PVP6
9.1	J1PVP7
7.7	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	8.8
Censored		Lognormal mean	8.8
Detection limit or PQL		Std. devn.	1.8
Method detection limit		Median	8.4
TOTAL	12	Min.	6.7
		Max.	13.6

Lognormal distribution? Normal distribution?
r-squared is: 0.903 r-squared is: 0.825
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9.8

Cobalt 95% UCL Calculation

DATA	ID
8.5	J1PVP0/ J1PVP9
8.5	J1PVN7
8.7	J1PVN8
9.1	J1PVN9
8.4	J1PVP1
11.1	J1PVP2
8.7	J1PVP3
9.4	J1PVP4
8.9	J1PVP5
7.9	J1PVP6
9.1	J1PVP7
8.9	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	8.9
Censored		Lognormal mean	8.9
Detection limit or PQL		Std. devn.	0.79
Method detection limit		Median	8.8
TOTAL	12	Min.	7.9
		Max.	11.1

Lognormal distribution? Normal distribution?
r-squared is: 0.822 r-squared is: 0.780
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 9.3

Copper 95% UCL Calculation

DATA	ID
16.4	J1PVP0/ J1PVP9
15.5	J1PVN7
16.3	J1PVN8
15.7	J1PVN9
14.1	J1PVP1
17.6	J1PVP2
15.9	J1PVP3
16.3	J1PVP4
14.1	J1PVP5
15.3	J1PVP6
17.6	J1PVP7
15.4	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	15.9
Censored		Lognormal mean	15.9
Detection limit or PQL		Std. devn.	1.1
Method detection limit		Median	15.8
TOTAL	12	Min.	14.1
		Max.	17.6

Lognormal distribution? Normal distribution?
r-squared is: 0.939 r-squared is: 0.941
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 16.5

Washington Closure Hanford
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CALCULATION SHEET

Date 09/12/12
Job No. 14655

Calc. No. 0100N-CA-V0151
Checked C. H. Dobie

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Ecology Software (MTCAStat) Results, 100-N-25 Excavation (EXC)

Lead 95% UCL Calculation

DATA	ID
4.6	J1PVP0/ J1PVP9
4.8	J1PVN7
4.0	J1PVN8
5.2	J1PVN9
4.1	J1PVP1
6.7	J1PVP2
6.7	J1PVP3
5.9	J1PVP4
4.3	J1PVP5
6.0	J1PVP6
3.9	J1PVP7
4.3	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	5.0
Censored		Lognormal mean	5.0
Detection limit or PQL		Std. devn.	1.0
Method detection limit		Median	4.7
TOTAL	12	Min.	3.9
		Max.	6.7

Lognormal distribution? Normal distribution?
r-squared is: 0.919 r-squared is: 0.898
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 5.6

Manganese 95% UCL Calculation

DATA	ID
318	J1PVP0/ J1PVP9
347	J1PVN7
325	J1PVN8
312	J1PVN9
304	J1PVP1
309	J1PVP2
327	J1PVP3
358	J1PVP4
316	J1PVP5
311	J1PVP6
317	J1PVP7
304	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	321
Censored		Lognormal mean	321
Detection limit or PQL		Std. devn.	16.6
Method detection limit		Median	317
TOTAL	12	Min.	304
		Max.	358

Lognormal distribution? Normal distribution?
r-squared is: 0.864 r-squared is: 0.850
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 329

Nickel 95% UCL Calculation

DATA	ID
10.3	J1PVP0/ J1PVP9
10.9	J1PVN7
13.4	J1PVN8
9.9	J1PVN9
9.7	J1PVP1
11.7	J1PVP2
11.3	J1PVP3
13.3	J1PVP4
10.3	J1PVP5
10.1	J1PVP6
10.8	J1PVP7
9.0	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	10.9
Censored		Lognormal mean	10.9
Detection limit or PQL		Std. devn.	1.4
Method detection limit		Median	10.6
TOTAL	12	Min.	9.0
		Max.	13.4

Lognormal distribution? Normal distribution?
r-squared is: 0.939 r-squared is: 0.913
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.6

Vanadium 95% UCL Calculation

DATA	ID
54.5	J1PVP0/ J1PVP9
54.6	J1PVN7
57.3	J1PVN8
61.7	J1PVN9
52.5	J1PVP1
70.6	J1PVP2
59.7	J1PVP3
60.3	J1PVP4
62.8	J1PVP5
57.2	J1PVP6
66.1	J1PVP7
61.4	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	59.9
Censored		Lognormal mean	59.9
Detection limit or PQL		Std. devn.	5.2
Method detection limit		Median	60.0
TOTAL	12	Min.	52.5
		Max.	70.6

Lognormal distribution? Normal distribution?
r-squared is: 0.974 r-squared is: 0.962
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 62.7

Zinc 95% UCL Calculation

DATA	ID
43.8	J1PVP0/ J1PVP9
53.7	J1PVN7
45.6	J1PVN8
48.5	J1PVN9
46.0	J1PVP1
48.6	J1PVP2
47.3	J1PVP3
48.5	J1PVP4
61.1	J1PVP5
46.9	J1PVP6
46.2	J1PVP7
47.0	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	48.6
Censored		Lognormal mean	48.6
Detection limit or PQL		Std. devn.	4.6
Method detection limit		Median	47.2
TOTAL	12	Min.	43.8
		Max.	61.1

Lognormal distribution? Normal distribution?
r-squared is: 0.769 r-squared is: 0.732
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 50.8

Chloride 95% UCL Calculation

DATA	ID
3.1	J1PVP0/ J1PVP9
3.5	J1PVN7
6.7	J1PVN8
3.5	J1PVN9
7.6	J1PVP1
2.1	J1PVP2
5.4	J1PVP3
6.4	J1PVP4
83.9	J1PVP5
10.3	J1PVP6
16.3	J1PVP7
2.0	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	12.6
Censored		Lognormal mean	10.7
Detection limit or PQL		Std. devn.	22.8
Method detection limit		Median	5.9
TOTAL	12	Min.	2.0
		Max.	83.9

Lognormal distribution? Normal distribution?
r-squared is: 0.868 r-squared is: 0.445
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 23.4

Fluoride 95% UCL Calculation

DATA	ID
0.70	J1PVP0/ J1PVP9
0.43	J1PVN7
1.3	J1PVN8
0.86	J1PVN9
0.91	J1PVP1
0.41	J1PVP2
1.0	J1PVP3
0.43	J1PVP4
0.42	J1PVP5
0.94	J1PVP6
0.42	J1PVP7
0.41	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.68
Censored		Lognormal mean	0.69
Detection limit or PQL		Std. devn.	0.31
Method detection limit		Median	0.56
TOTAL	12	Min.	0.41
		Max.	1.3

Lognormal distribution? Normal distribution?
r-squared is: 0.837 r-squared is: 0.842
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.83

Nitrogen in nitrate 95% UCL Calculation

DATA	ID
2.4	J1PVP0/ J1PVP9
1.5	J1PVN7
1.3	J1PVN8
3.2	J1PVN9
7.1	J1PVP1
0.91	J1PVP2
8.1	J1PVP3
15.0	J1PVP4
2.9	J1PVP5
10.2	J1PVP6
26.8	J1PVP7
0.59	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	6.7
Censored		Lognormal mean	7.4
Detection limit or PQL		Std. devn.	7.7
Method detection limit		Median	3.1
TOTAL	12	Min.	0.59
		Max.	26.8

Lognormal distribution? Normal distribution?
r-squared is: 0.982 r-squared is: 0.766
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 23.7

Nitrogen in nitrate and nitrite 95% UCL Calculation

DATA	ID
2.2	J1PVP0/ J1PVP9
1.0	J1PVN7
0.88	J1PVN8
2.9	J1PVN9
7.0	J1PVP1
0.15	J1PVP2
8.2	J1PVP3
16.5	J1PVP4
2.9	J1PVP5
11.0	J1PVP6
27.4	J1PVP7
0.15	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	6.7
Censored		Lognormal mean	11.1
Detection limit or PQL		Std. devn.	8.2
Method detection limit		Median	2.9
TOTAL	12	Min.	0.15
		Max.	27.4

Lognormal distribution? Normal distribution?
r-squared is: 0.949 r-squared is: 0.786
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 103

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Sulfate 95% UCL Calculation

DATA	ID
7.4	J1PVP0/ J1PVP9
12.7	J1PVN7
15.8	J1PVN8
18.1	J1PVN9
13.6	J1PVP1
3.7	J1PVP2
15.1	J1PVP3
30.8	J1PVP4
8.3	J1PVP5
19.6	J1PVP6
35.9	J1PVP7
3.0	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	15.3
Censored		Lognormal mean	16.3
Detection limit or PQL		Std. devn.	10.0
Method detection limit		Median	14.4
TOTAL	12	Min.	3.0
		Max.	35.9

Lognormal distribution? Normal distribution?
r-squared is: 0.947 r-squared is: 0.923
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 28.8

TPH - Diesel Range 95% UCL Calculation

DATA	ID
2300	J1PVP0/ J1PVP9
3900	J1PVN7
870	J1PVN8
4300	J1PVN9
1100	J1PVP1
5400	J1PVP2
3400	J1PVP3
1100	J1PVP4
3200	J1PVP5
6000	J1PVP6
2100	J1PVP7
12000	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	3806
Censored		Lognormal mean	3938
Detection limit or PQL		Std. devn.	3071
Method detection limit		Median	3300
TOTAL	12	Min.	870
		Max.	12000

Lognormal distribution? Normal distribution?
r-squared is: 0.967 r-squared is: 0.808
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 7157

TPH - Diesel Range Extended 95% UCL Calculation

DATA	ID
3050	J1PVP0/ J1PVP9
5000	J1PVN7
475	J1PVN8
7000	J1PVN9
1500	J1PVP1
8700	J1PVP2
5500	J1PVP3
1500	J1PVP4
5600	J1PVP5
11000	J1PVP6
3100	J1PVP7
14000	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	5535
Censored		Lognormal mean	6336
Detection limit or PQL		Std. devn.	4093
Method detection limit		Median	5250
TOTAL	12	Min.	475
		Max.	14000

Lognormal distribution? Normal distribution?
r-squared is: 0.934 r-squared is: 0.940
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 14657

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
1.6	J1PVP0/ J1PVP9
1.6	J1PVN7
1.6	J1PVN8
110	J1PVN9
1.6	J1PVP1
61	J1PVP2
19	J1PVP3
1.6	J1PVP4
7.5	J1PVP5
110	J1PVP6
5.0	J1PVP7
1.5	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	27
Censored		Lognormal mean	32
Detection limit or PQL		Std. devn.	42
Method detection limit		Median	3.3
TOTAL	12	Min.	1.5
		Max.	110

Lognormal distribution? Normal distribution?
r-squared is: 0.811 r-squared is: 0.653
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 47

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
3.1	J1PVP0/ J1PVP9
3.3	J1PVN7
3.1	J1PVN8
80	J1PVN9
3.2	J1PVP1
46	J1PVP2
22	J1PVP3
3.3	J1PVP4
8.7	J1PVP5
100	J1PVP6
13	J1PVP7
11	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	25
Censored		Lognormal mean	26
Detection limit or PQL		Std. devn.	33
Method detection limit		Median	10
TOTAL	12	Min.	3.1
		Max.	100

Lognormal distribution? Normal distribution?
r-squared is: 0.880 r-squared is: 0.711
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 40

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
2.0	J1PVP0/ J1PVP9
2.2	J1PVN7
2.1	J1PVN8
90	J1PVN9
2.1	J1PVP1
69	J1PVP2
26	J1PVP3
2.2	J1PVP4
11	J1PVP5
120	J1PVP6
13	J1PVP7
14	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	29
Censored		Lognormal mean	37
Detection limit or PQL		Std. devn.	40
Method detection limit		Median	12
TOTAL	12	Min.	2.0
		Max.	120

Lognormal distribution? Normal distribution?
r-squared is: 0.878 r-squared is: 0.730
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 49

Benzo(k)fluoranthene 95% UCL Calculation

DATA	ID
1.9	J1PVP0/ J1PVP9
2.0	J1PVN7
1.9	J1PVN8
31	J1PVN9
2.0	J1PVP1
22	J1PVP2
12	J1PVP3
2.0	J1PVP4
6.4	J1PVP5
48	J1PVP6
6.0	J1PVP7
5.7	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	12
Censored		Lognormal mean	12
Detection limit or PQL		Std. devn.	14
Method detection limit		Median	5.9
TOTAL	12	Min.	1.9
		Max.	46

Lognormal distribution? Normal distribution?
r-squared is: 0.883 r-squared is: 0.735
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 18

Chrysene 95% UCL Calculation

DATA	ID
2.3	J1PVP0/ J1PVP9
2.5	J1PVN7
2.4	J1PVN8
110	J1PVN9
2.4	J1PVP1
71	J1PVP2
26	J1PVP3
2.5	J1PVP4
9.8	J1PVP5
140	J1PVP6
17	J1PVP7
13	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	33
Censored		Lognormal mean	40
Detection limit or PQL		Std. devn.	47
Method detection limit		Median	11
TOTAL	12	Min.	2.3
		Max.	140

Lognormal distribution? Normal distribution?
r-squared is: 0.882 r-squared is: 0.711
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 56

Fluoranthene 95% UCL Calculation

DATA	ID
6.3	J1PVP0/ J1PVP9
6.5	J1PVN7
6.5	J1PVN8
180	J1PVN9
6.5	J1PVP1
100	J1PVP2
39	J1PVP3
6.5	J1PVP4
18	J1PVP5
210	J1PVP6
28	J1PVP7
18	J1PVP8

Number of samples		Uncensored values	
Uncensored	12	Mean	52
Censored		Lognormal mean	55
Detection limit or PQL		Std. devn.	72
Method detection limit		Median	18
TOTAL	12	Min.	6.3
		Max.	210

Lognormal distribution? Normal distribution?
r-squared is: 0.868 r-squared is: 0.692
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 86

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Washington Closure Hanford

Originator J. D. Skoglie **Date** 09/12/12 **Calc. No.** 0100N-CA-V0151 **Rev. No.** 0

Project 100-N Field Remediation **Job No.** 14655 **Checked** C. H. Dobie **Date** 09/12/12

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Ecology Software (MTCAStat) Results, 100-N-25 Excavation (EXC)

	DATA	ID	Pyrene 95% UCL Calculation			
2	6.0	J1PVP0/ J1PVP9				
3	6.0	J1PVN7				
4	6.0	J1PVN8	Number of samples		Uncensored values	
5	180	J1PVN9	Uncensored	12	Mean	55
6	6.0	J1PVP1	Censored		Lognormal mean	59
7	83	J1PVP2	Detection limit or PQL		Std. devn.	80
8	50	J1PVP3	Method detection limit		Median	19
9	6.0	J1PVP4	TOTAL	12	Min.	6.0
10	15	J1PVP5			Max.	250
11	250	J1PVP6				
12	30	J1PVP7				
13	22	J1PVP8				
14						
15			Lognormal distribution?		Normal distribution?	
16			r-squared is: 0.879		r-squared is: 0.682	
17			Recommendations:			
18			Reject BOTH lognormal and normal distributions.			
19						
20			UCL (based on Z-statistic) is 93			

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-25 Waste Sites Cleanup Verification 95% UCL Calculations

Date 09/12/12
Job No. 14655

Calc. No. 0100N-CA-V0151
Checked C. H. Dobie

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Duplicate Analysis - 100-N-25 Excavation (EXC)

Sampling Area	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	7570	X	1.5	0.85	J	0.36	2.4		0.62	58.9	X	0.071	0.23		0.031	0.12	B	0.038	6400	JX	13.2	8.3	X	0.054	8.5	X	0.094
Duplicate of J1PVP0	J1PVP9	7/24/12	7700	X	1.5	0.72	J	0.37	1.9		0.64	57.1	X	0.074	0.19		0.032	0.11	B	0.040	7030	JX	13.7	7.8	X	0.056	8.4	X	0.097

Analysis:

		TDL	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt
			5	0.6	10	2	0.2	0.2	100	1	2
Duplicate Analysis	Both > PQL?		Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		1.7%			3.1%			9.4%	6.2%	
	Difference > 2 TDL?		Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 100-N-25 Excavation (EXC)

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	16.1		0.20	21100	X	3.6	4.6		0.25	4670	X	3.5	322	X	0.094	10.3	X	0.12	1230		38.4	393	J	5.3	298		55.2
Duplicate of J1PVP0	J1PVP9	7/24/12	16.7		0.21	21400	X	3.7	4.5		0.26	4440	X	3.6	314	X	0.097	10.2	X	0.12	1200		39.9	409	J	5.5	363		57.4

Analysis:

		TDL	Copper	Iron	Lead	Magnesium	Manganese	Nickel	Potassium	Silicon	Sodium
			1	5	5	75	5	4	400	2	50
Duplicate Analysis	Both > PQL?		Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD		3.7%	1.4%		5.0%	2.5%			4.0%	19.7%
	Difference > 2 TDL?		Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 100-N-25 Excavation (EXC)

Sampling Area	HEIS Number	Sample Date	Vanadium			Zinc			Chloride			Nitrogen in Nitrate			Nitrogen in Nitrite and Nitrate			Sulfate			TPH - Diesel Range			TPH - Diesel Range Extended		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	53.5	X	0.088	44.3	X	0.37	3.2	B	1.9	2.5	J	0.31	2.3		0.29	7.5		1.7	2600	J	650	3300	J	960
Duplicate of J1PVP0	J1PVP9	7/24/12	55.4	X	0.091	43.3	X	0.39	2.9	B	2.0	2.2	JB	0.31	2.0		0.29	7.3		1.7	2000	J	690	2800	J	1000

Analysis:

		TDL	Vanadium	Zinc	Chloride	Nitrogen in Nitrate	Nitrogen in Nitrite and Nitrate	Sulfate	TPH - Diesel Range	TPH - Diesel Range Extended
			2.5	1	2	0.75	0.75	5	5000	5000
Duplicate Analysis	Both > PQL?		Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD		3.5%	2.3%						
	Difference > 2 TDL?		Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

Qualifiers are defined on sheet 3

Attachment 1. 100-N-25 Waste Site Verification Sample Results (Metals).

SAMPLE LOCATION	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	7570	X	1.5	0.85	J	0.36	2.4		0.62	58.9	X	0.071	0.23		0.031	1.1	B	0.92
Duplicate of J1PVP0	J1PVP9	7/24/12	7700	X	1.5	0.72	J	0.37	1.9		0.64	57.1	X	0.074	0.19		0.032	0.95	U	0.95
EXC-1	J1PVN7	7/24/12	8530	X	1.6	1.6	JM	0.38	1.8		0.66	80.2	X	0.076	0.22		0.033	1.8	B	0.99
EXC-2	J1PVN8	7/24/12	7950	X	1.5	1.0	J	0.36	1.8		0.62	57.1	X	0.071	0.21		0.031	1.5	B	0.92
EXC-3	J1PVN9	7/24/12	5700	X	1.5	0.63	J	0.38	1.6		0.65	58.0	X	0.075	0.14	B	0.033	1.0	B	0.97
EXC-5	J1PVP1	7/24/12	6170	X	1.4	0.99	J	0.34	2.3		0.59	44.1	X	0.068	0.16	B	0.029	0.87	U	0.87
EXC-6	J1PVP2	7/24/12	6290	X	1.4	1.0	J	0.33	1.0		0.58	54.6	X	0.066	0.14	U	0.14	0.86	U	0.86
EXC-7	J1PVP3	7/24/12	7410	X	1.3	0.64	J	0.32	1.9		0.56	61.2	X	0.065	0.19		0.028	1.1	B	0.83
EXC-8	J1PVP4	7/24/12	8370	X	1.4	0.89	J	0.35	2.6		0.61	49.1	X	0.070	0.25		0.031	0.91	U	0.91
EXC-9	J1PVP5	7/24/12	6420	X	1.5	0.66	J	0.37	1.7		0.65	54.7	X	0.075	0.14	B	0.033	1.6	B	0.97
EXC-10	J1PVP6	7/24/12	7040	X	1.5	0.52	JB	0.37	1.8		0.65	63.8	X	0.074	0.16	B	0.032	1.0	B	0.96
EXC-11	J1PVP7	7/24/12	6820	X	1.5	0.68	J	0.37	1.9		0.64	49.1	X	0.074	0.15	B	0.032	0.96	B	0.96
EXC-12	J1PVP8	7/24/12	5800	X	1.4	0.73	J	0.35	0.99		0.61	54.8	X	0.070	0.13	B	0.031	0.91	U	0.91
Equipment Blank	J1PVR0	7/24/12	246	X	1.5	0.37	UJ	0.37	0.65	U	0.65	2.5	X	0.075	0.032	U	0.032	0.96	U	0.96

SAMPLE LOCATION	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	0.12	B	0.038	6400	JX	13.2	8.3	X	0.054	8.5	X	0.094	16.1		0.20	21100	X	3.6
Duplicate of J1PVP0	J1PVP9	7/24/12	0.11	B	0.040	7030	JX	13.7	7.8	X	0.056	8.4	X	0.097	16.7		0.21	21400	X	3.7
EXC-1	J1PVN7	7/24/12	0.15	B	0.041	4950	JXM	14.2	13.6	X	0.058	8.5	X	0.10	15.5		0.22	22200	X	3.8
EXC-2	J1PVN8	7/24/12	0.14	B	0.038	5800	JX	13.2	9.3	X	0.054	8.7	X	0.094	16.3		0.20	22800	X	3.6
EXC-3	J1PVN9	7/24/12	0.13	B	0.041	8530	JX	14.0	6.7	X	0.058	9.1	X	0.099	15.7		0.22	22800	X	3.8
EXC-5	J1PVP1	7/24/12	0.12	B	0.037	6500	JX	12.6	7.3	X	0.052	8.4	X	0.089	14.1		0.19	21300	X	3.4
EXC-6	J1PVP2	7/24/12	0.12	B	0.036	6400	JX	12.3	8.1	X	0.051	11.1	X	0.44	17.6		0.95	23300	X	3.3
EXC-7	J1PVP3	7/24/12	0.14	B	0.035	5730	JX	12.0	10.0	X	0.049	8.7	X	0.085	15.9		0.18	22600	X	3.2
EXC-8	J1PVP4	7/24/12	0.10	B	0.038	7250	JX	13.1	8.6	X	0.054	9.4	X	0.093	16.3		0.20	23600	X	3.5
EXC-9	J1PVP5	7/24/12	0.14	B	0.040	5500	JX	13.9	7.7	X	0.057	8.9	X	0.099	14.1		0.21	23300	X	3.7
EXC-10	J1PVP6	7/24/12	0.12	B	0.040	6150	JX	13.8	9.6	X	0.057	7.9	X	0.098	15.3		0.21	20300	X	3.7
EXC-11	J1PVP7	7/24/12	0.12	B	0.040	7580	JX	13.7	9.1	X	0.057	9.1	X	0.098	17.6		0.21	23900	X	3.7
EXC-12	J1PVP8	7/24/12	0.14	B	0.038	5070	JX	13.0	7.7	X	0.054	8.9	X	0.093	15.4		0.20	22600	X	3.5
Equipment Blank	J1PVR0	7/24/12	0.040	U	0.040	46.1	JBX	13.8	0.17	UJBCX	0.057	0.11	BX	0.098	0.21	U	0.21	291	X	3.7

Note: Data qualified with B, C, and/or J are considered acceptable values.

B = estimated result

C = ≤5x blank concentration

HEIS = Hanford Environmental Information System

J = result < RL but ≥MDL and the concentration is an approximate value.

M = sample duplicate not met

N = recovery outside control limits

PAH = polycyclic aromatic hydrocarbons

PQL = practical quantitation limit

Q = qualifier

U = undetected

X = >40% difference between columns, lower result reported (organics).

X = serial dilution indicates physical and chemical interferences present (metals).

Attachment	1	Sheet No.	1 of 4
Originator	J. D. Skoglie	Date	9/12/2012
Checked	C. H. Dobie	Date	9/12/2012
Calc. No.	0100N-CA-V0151	Rev. No.	0

Attachment 1. 100-N-25 Waste Site Verification Sample Results (Metals).

SAMPLE LOCATION	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	4.6		0.25	4670	X	3.5	322	X	0.094	0.0047	U	0.0047	0.24	U	0.24	10.3	X	0.12
Duplicate of J1PVP0	J1PVP9	7/24/12	4.5		0.26	4440	X	3.6	314	X	0.097	0.0054	U	0.0054	0.25	U	0.25	10.2	X	0.12
EXC-1	J1PVN7	7/24/12	4.8		0.27	4330	X	3.7	347	X	0.10	0.0064	U	0.0064	0.36	B	0.26	10.9	X	0.12
EXC-2	J1PVN8	7/24/12	4.0		0.25	4970	X	3.5	325	X	0.094	0.0056	U	0.0056	0.33	B	0.24	13.4	X	0.12
EXC-3	J1PVN9	7/24/12	5.2		0.27	4540	X	3.7	312	X	0.099	0.0066	U	0.0066	0.26	U	0.26	9.9	X	0.12
EXC-5	J1PVP1	7/24/12	4.1		0.24	4890	X	3.3	304	X	0.089	0.0054	U	0.0054	0.23	U	0.23	9.7	X	0.11
EXC-6	J1PVP2	7/24/12	6.7		1.2	4600	X	3.2	309	X	0.087	0.0052	U	0.0052	0.23	U	0.23	11.7	X	0.11
EXC-7	J1PVP3	7/24/12	6.7		0.23	4470	X	3.1	327	X	0.085	0.0053	U	0.0053	0.22	U	0.22	11.3	X	0.10
EXC-8	J1PVP4	7/24/12	5.9		0.25	5820	X	3.4	358	X	0.093	0.0051	U	0.0051	0.24	U	0.24	13.3	X	0.11
EXC-9	J1PVP5	7/24/12	4.3		0.27	4470	X	3.6	316	X	0.099	0.0049	U	0.0049	0.26	U	0.26	10.3	X	0.12
EXC-10	J1PVP6	7/24/12	6.0		0.26	4230	X	3.6	311	X	0.098	0.0067	U	0.0067	0.25	U	0.25	10.1	X	0.12
EXC-11	J1PVP7	7/24/12	3.9		0.26	4900	X	3.6	317	X	0.098	0.0059	U	0.0059	0.25	U	0.25	10.8	X	0.12
EXC-12	J1PVP8	7/24/12	4.3		0.25	3870	X	3.4	304	X	0.093	0.0049	U	0.0049	0.24	U	0.24	9.0	X	0.11
Equipment Blank	J1PVR0	7/24/12	0.48	B	0.26	28.6	X	3.6	5.1	X	0.098	0.0059	U	0.0059	0.25	U	0.25	0.17	BX	0.12

SAMPLE LOCATION	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	1230		38.4	0.80	U	0.80	393	J	5.3	0.15	U	0.15	298		55.2	53.5	X	0.088
Duplicate of J1PVP0	J1PVP9	7/24/12	1200		39.9	0.84	U	0.84	409	J	5.5	0.16	U	0.16	363		57.4	55.4	X	0.091
EXC-1	J1PVN7	7/24/12	1680		41.2	0.86	U	0.86	444	JN	5.7	0.16	U	0.16	300		59.3	54.6	X	0.095
EXC-2	J1PVN8	7/24/12	1250		38.5	0.81	U	0.81	540	J	5.3	0.15	U	0.15	314		55.3	57.3	X	0.088
EXC-3	J1PVN9	7/24/12	802		40.7	0.85	U	0.85	230	J	5.6	0.16	U	0.16	347		58.5	61.7	X	0.093
EXC-5	J1PVP1	7/24/12	928		36.6	0.77	U	0.77	278	J	5.0	0.14	U	0.14	297		52.6	52.5	X	0.084
EXC-6	J1PVP2	7/24/12	893		35.8	3.8	U	3.8	299	J	4.9	0.14	U	0.14	396		51.5	70.6	X	0.41
EXC-7	J1PVP3	7/24/12	1230		34.9	0.73	U	0.73	323	J	4.8	0.14	U	0.14	318		50.2	59.7	X	0.080
EXC-8	J1PVP4	7/24/12	1280		38.0	0.80	U	0.80	282	J	5.2	0.15	U	0.15	359		54.7	60.3	X	0.087
EXC-9	J1PVP5	7/24/12	967		40.4	0.85	U	0.85	325	J	5.6	0.16	U	0.16	333		58.2	62.8	X	0.093
EXC-10	J1PVP6	7/24/12	1110		40.2	0.84	U	0.84	403	J	5.5	0.16	U	0.16	347		57.8	57.2	X	0.092
EXC-11	J1PVP7	7/24/12	1010		40.0	0.84	U	0.84	354	J	5.5	0.16	U	0.16	339		57.5	66.1	X	0.092
EXC-12	J1PVP8	7/24/12	919		37.9	0.80	U	0.80	299	J	5.2	0.15	U	0.15	312		54.6	61.4	X	0.087
Equipment Blank	J1PVR0	7/24/12	55.8	B	40.2	0.84	U	0.84	136	J	5.5	0.16	U	0.16	57.8	U	57.8	0.33	BX	0.092

SAMPLE LOCATION	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	44.3	X	0.37
Duplicate of J1PVP0	J1PVP9	7/24/12	43.3	X	0.39
EXC-1	J1PVN7	7/24/12	53.7	X	0.40
EXC-2	J1PVN8	7/24/12	45.6	X	0.37
EXC-3	J1PVN9	7/24/12	48.5	X	0.39
EXC-5	J1PVP1	7/24/12	46.0	X	0.35
EXC-6	J1PVP2	7/24/12	48.6	X	0.35
EXC-7	J1PVP3	7/24/12	47.3	X	0.34
EXC-8	J1PVP4	7/24/12	48.5	X	0.37
EXC-9	J1PVP5	7/24/12	61.1	X	0.39
EXC-10	J1PVP6	7/24/12	46.9	X	0.39
EXC-11	J1PVP7	7/24/12	46.2	X	0.39
EXC-12	J1PVP8	7/24/12	47.0	X	0.37
Equipment Blank	J1PVR0	7/24/12	1.5	UJCX	0.39

Attachment	1	Sheet No.	2 of 4
Originator	J. D. Skoglie	Date	9/12/2012
Checked	C. H. Dobie	Date	9/12/2012
Calc. No.	0100N-CA-V0151	Rev. No.	0

Attachment 1. 100-N-25 Waste Site Verification Sample Results (Anions and TPH).

SAMPLE LOCATION	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite			Nitrogen in Nitrite and Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-4	J1PVP0	7/24/12	0.38	U	0.38	3.2	B	1.9	0.99	B	0.81	2.5	J	0.31	0.33	UJ	0.33	2.3		0.29
Duplicate of J1PVP0	J1PVP9	7/24/12	0.39	U	0.39	2.9	B	2.0	0.82	U	0.82	2.2	JB	0.31	0.34	UJ	0.34	2.0		0.29
EXC-1	J1PVN7	7/24/12	0.40	U	0.40	3.5	B	2.0	0.85	U	0.85	1.5	JB	0.33	0.35	UJ	0.35	1.0	M	0.31
EXC-2	J1PVN8	7/24/12	0.39	U	0.39	6.7		2.0	1.3	B	0.82	1.3	JB	0.31	0.33	UJ	0.33	0.88		0.30
EXC-3	J1PVN9	7/24/12	0.39	U	0.39	3.5	B	2.0	0.86	B	0.83	3.2	J	0.32	0.34	UJ	0.34	2.9		0.30
EXC-5	J1PVP1	7/24/12	0.39	U	0.39	7.6		2.0	0.91	B	0.84	7.1	J	0.32	0.34	UJ	0.34	7.0		0.30
EXC-6	J1PVP2	7/24/12	0.39	U	0.39	2.1	B	2.0	0.82	U	0.82	0.91	JB	0.31	0.34	UJ	0.34	0.29	U	0.29
EXC-7	J1PVP3	7/24/12	0.38	U	0.38	5.4		1.9	1.0	B	0.81	8.1	J	0.31	0.33	UJ	0.33	8.2		0.29
EXC-8	J1PVP4	7/24/12	0.79	B	0.40	6.4		2.0	0.85	U	0.85	15.0	J	0.32	0.35	UJ	0.35	16.5		0.31
EXC-9	J1PVP5	7/24/12	0.88	B	0.39	83.9		2.0	0.84	U	0.84	2.9	J	0.32	0.34	UJ	0.34	2.9		0.30
EXC-10	J1PVP6	7/24/12	0.38	U	0.38	10.3		1.9	0.94	B	0.81	10.2	J	0.31	0.33	UJ	0.33	11.0		0.30
EXC-11	J1PVP7	7/24/12	0.39	U	0.39	16.3		2.0	0.83	U	0.83	26.8	J	0.32	0.34	UJ	0.34	27.4		0.30
EXC-12	J1PVP8	7/24/12	0.38	U	0.38	2.0	B	1.9	0.81	U	0.81	0.59	JB	0.31	0.33	UJ	0.33	0.30	U	0.30
Equipment Blank	J1PVR0	7/24/12																		

SAMPLE LOCATION	HEIS Number	Sample Date	Orthophosphate			Sulfate			TPH - Diesel Range			TPH - Diesel Range Extended			Percent moisture (wet sample)			pH Measurement		
			mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL	pH	Q	PQL
EXC-4	J1PVP0	7/24/12	1.2	UJ	1.2	7.5		1.7	2600	J	650	3300	J	960	1.0		0.10	9.06	J	0.100
Duplicate of J1PVP0	J1PVP9	7/24/12	1.2	UJ	1.2	7.3		1.7	2000	J	690	2800	J	1000	1.2		0.10	8.99	J	0.100
EXC-1	J1PVN7	7/24/12	1.3	UJ	1.3	12.7		1.8	3900	J	700	5000		1000	4.4		0.10	8.75	J	0.100
EXC-2	J1PVN8	7/24/12	1.2	UJ	1.2	15.8		1.7	870	J	640	950	U	950	1.3		0.10	9.04	J	0.100
EXC-3	J1PVN9	7/24/12	1.3	JB	1.3	18.1		1.7	4300		670	7000		980	3.0		0.10	9.07	J	0.100
EXC-5	J1PVP1	7/24/12	1.3	UJ	1.3	13.6		1.8	1100	J	680	1500	J	1000	1.6		0.10	9.06	J	0.100
EXC-6	J1PVP2	7/24/12	1.2	UJ	1.2	3.7	B	1.7	5400		660	8700		960	1.2		0.10	9.08	J	0.100
EXC-7	J1PVP3	7/24/12	1.2	UJ	1.2	15.1		1.7	3400	J	660	5500		980	1.3		0.10	8.93	J	0.100
EXC-8	J1PVP4	7/24/12	1.3	UJ	1.3	30.8		1.8	1100	J	680	1500	J	1000	3.7		0.10	8.87	J	0.100
EXC-9	J1PVP5	7/24/12	1.3	UJ	1.3	8.3		1.8	3200	J	650	5600		960	1.6		0.10	8.60	J	0.100
EXC-10	J1PVP6	7/24/12	1.2	UJ	1.2	19.6		1.7	6000		630	11000		930	0.89		0.10	8.73	J	0.100
EXC-11	J1PVP7	7/24/12	1.2	UJ	1.2	35.9		1.7	2100	J	640	3100	J	940	1.4		0.10	8.63	J	0.100
EXC-12	J1PVP8	7/24/12	1.2	UJ	1.2	3.0	B	1.7	12000		620	14000		920	0.87		0.10	8.96	J	0.100
Equipment Blank	J1PVR0	7/24/12													0.10	U	0.10			

Attachment	1	Sheet No.	3 of 4
Originator	J. D. Skoglie	Date	9/12/2012
Checked	C. H. Dobie	Date	9/12/2012
Calc. No.	0100N-CA-V0151	Rev. No.	0

Attachment 1. 100-N-25 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-4 - J1PVP0			Duplicate of J1PVP0 - J1PVP9			EXC-1 - J1PVN7			EXC-2 - J1PVN8			EXC-3 - J1PVN9			EXC-5 - J1PVP1			EXC-6 - J1PVP2		
		7/24/12			7/24/12			7/24/12			7/24/12			7/24/12			7/24/12			7/24/12		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.7	U	9.7	9.6	U	9.6	10	U	10	9.6	U	9.6	17	JX	10	9.8	U	9.8	9.9	U	9.9
Acenaphthylene	PAH	8.7	U	8.7	8.6	U	8.6	9.2	U	9.2	8.7	U	8.7	9.3	U	9.3	8.9	U	8.9	8.9	U	8.9
Anthracene	PAH	2.9	U	2.9	2.9	U	2.9	3.1	U	3.1	2.9	U	2.9	27		3.1	3.0	U	3.0	11	J	3.0
Benzo(a)anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.2	U	3.2	3.1	U	3.1	110		3.3	3.1	U	3.1	61		3.1
Benzo(a)pyrene	PAH	6.2	U	6.2	6.2	U	6.2	6.5	U	6.5	6.2	U	6.2	80		6.6	6.3	U	6.3	46		6.3
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4.0	U	4.0	4.3	U	4.3	4.1	U	4.1	90		4.3	4.1	U	4.1	69		4.1
Benzo(ghi)perylene	PAH	7.0	U	7.0	6.9	U	6.9	7.3	U	7.3	6.9	U	6.9	57		7.4	7.1	U	7.1	39		7.1
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.8	U	3.8	4.0	U	4.0	3.8	U	3.8	31		4.1	3.9	U	3.9	22		3.9
Chrysene	PAH	4.7	U	4.7	4.6	U	4.6	4.9	U	4.9	4.7	U	4.7	110		5.0	4.8	U	4.8	71		4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	12	U	12	13	U	13	13	U	13	180		13	13	U	13	100		13
Fluorene	PAH	5.1	U	5.1	5.1	U	5.1	5.4	U	5.4	5.1	U	5.1	16	JX	5.4	5.2	U	5.2	8.8	J	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	52		12	12	U	12	40		12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	88		12	12	U	12	31	J	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	180		12	12	U	12	83		12

CONSTITUENT	CLASS	EXC-7 - J1PVP3			EXC-8 - J1PVP4			EXC-9 - J1PVP5			EXC-10 - J1PVP6			EXC-11 - J1PVP7			EXC-12 - J1PVP8		
		7/24/12			7/24/12			7/24/12			7/24/12			7/24/12			7/24/12		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.5	U	9.5	10	U	10	9.3	U	9.3	22	JX	9.3	10	U	10	9.5	U	9.5
Acenaphthylene	PAH	8.5	U	8.5	9.2	U	9.2	8.3	U	8.3	8.3	U	8.3	9.0	U	9.0	8.6	U	8.6
Anthracene	PAH	2.9	U	2.9	3.1	U	3.1	2.8	U	2.8	27		2.8	3.1	U	3.1	2.9	U	2.9
Benzo(a)anthracene	PAH	19	X	3.0	3.2	U	3.2	7.5	J	3.0	110		3.0	5.0	JX	3.2	3.0	U	3.0
Benzo(a)pyrene	PAH	22		6.1	6.5	U	6.5	8.7	JX	5.9	100		5.9	13	J	6.4	11	J	6.1
Benzo(b)fluoranthene	PAH	26		4.0	4.3	U	4.3	11	JX	3.9	120		3.9	13	J	4.2	14	X	4.0
Benzo(ghi)perylene	PAH	18	J	6.8	7.3	U	7.3	6.7	U	6.7	52	X	6.7	7.2	U	7.2	9.1	J	6.9
Benzo(k)fluoranthene	PAH	12	J	3.7	4.0	U	4.0	6.4	J	3.7	46		3.6	6.0	J	4.0	5.7	J	3.7
Chrysene	PAH	26	J	4.6	4.9	U	4.9	9.8	J	4.5	140		4.5	17	J	4.9	13	J	4.6
Dibenz[a,h]anthracene	PAH	10	U	10	11	U	11	10	U	10	29		10	11	U	11	10	U	10
Fluoranthene	PAH	39		12	13	U	13	18	J	12	210		12	28	J	13	18	J	12
Fluorene	PAH	5.0	U	5.0	5.4	U	5.4	4.9	U	4.9	18	JX	4.9	5.3	U	5.3	5.0	U	5.0
Indeno(1,2,3-cd)pyrene	PAH	15	J	11	12	U	12	11	U	11	67		11	12	U	12	11	U	11
Naphthalene	PAH	11	U	11	12	U	12	11	U	11	11	U	11	12	U	12	11	U	11
Phenanthrene	PAH	11	U	11	12	U	12	11	U	11	94		11	12	J	12	11	U	11
Pyrene	PAH	50		11	12	U	12	15	J	11	250		11	30	J	12	22	J	11

Attachment	1	Sheet No.	4 of 4
Originator	J. D. Skoglie	Date	9/12/2012
Checked	C. H. Dobie	Date	9/12/2012
Calc. No.	0100N-CA-V0151	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-N Field Remediation Job No. 14655

Area: 100-N

Discipline: Environmental Calculation No: 0100N-CA-V0152

Subject: 100-N-25 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 3 Total = 4	J. D. Skeglie	C. H. Dobie	N. K. Schiffern	D. F. Obenauer	12/20/12

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007)

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	10/15/2012	Calc. No.:	0100N-CA-V0152	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/15/2012
Subject:	100-N-25 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 100-N-25 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2006b), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2006a, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites*, DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2006b, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area*, DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington

3) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

4) WCH, 2012, *Remaining Sites Verification Package for the 100-N-25, French Drain 1 Liquid Waste Site*, Attachment to Waste Site Reclassification Form 2012-079, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (DOE-RL 2006b).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $<1 \times 10^{-6}$ (DOE-RL 2006b).

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	10/15/2012	Calc. No.:	0100N-CA-V0152	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/15/2012
Subject:	100-N-25 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 3

METHODOLOGY:

The 100-N-25 waste site is comprised of one decision unit for verification sampling consisting of the excavation area. The direct contact hazard quotient and carcinogenic risk calculations for the 100-N-25 waste site was conservatively calculated for the entire waste site using the greater of the maximum or statistical verification soil sample results (WCH 2012). Of the contaminants of potential concern (COPCs) for this site, boron, molybdenum, and the detected polycyclic aromatic hydrocarbons (PAHs) require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Nitrogen in nitrate and nitrite require HQ and risk calculations because this analyte was detected above the Washington State or Hanford Site background value. Although total petroleum hydrocarbons (diesel range extended) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the statistical value for boron is 1.4 mg/kg, divided by the noncarcinogenic RAG value of 16,000 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 8.8×10^{-5}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 1.9×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the statistical value for benzo(b)flouranthene is 0.049 mg/kg, divided by 1.37 mg/kg, and multiplied as indicated, is 3.6×10^{-8}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 6.2×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk $>1 \times 10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens $>1 \times 10^{-5}$: None

Table 1 shows the results of the hazard quotient and excess cancer risk calculations.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	10/15/2012	Calc. No.:	0100N-CA-V0152	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/15/2012
Subject:	100-N-25 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 3

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-N-25 Waste Site.

Contaminants of Potential Concern	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.4	16,000	8.8E-05	--	--
Molybdenum	0.36	400	9.0E-04	--	--
Anions					
Nitrogen in nitrate and nitrite	103	128,000	8.0E-04	--	--
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.022	4,800	4.6E-06	--	--
Anthracene	0.027	24,000	1.1E-06	--	--
Benzo(a)anthracene	0.047	--	--	1.37	3.4E-08
Benzo(a)pyrene	0.040	--	--	0.137	2.9E-07
Benzo(b)fluoranthene	0.049	--	--	1.37	3.6E-08
Benzo(ghi)perylene[c]	0.057	2,400	2.4E-05	--	--
Benzo(k)fluoranthene	0.018	--	--	13.7	1.3E-09
Chrysene	0.056	--	--	137	4.1E-10
Dibenz(a,h)anthracene	0.029	--	--	0.137	2.1E-07
Fluoranthene	0.086	3,200	2.7E-05	--	--
Fluorene	0.018	3,200	5.6E-06	--	--
Indeno(1,2,3-cd)pyrene	0.067	--	--	1.37	4.9E-08
Phenanthrene[c]	0.094	24,000	3.9E-06	--	--
Pyrene	0.093	2,400	3.9E-05	--	--
Totals					
Cumulative Hazard Quotient:			**1.9E-03**		
Cumulative Excess Cancer Risk:					**6.2E-07**

Notes:

[a] = From WCH (2012).

[b] = Value obtained from the 100-N Area RDR/RAWP (DOE-RL 2006b) or *Washington Administrative Code* (WAC) 173-340-740(3 Method B, 1996, unless otherwise noted.

[c] = Toxicity data for these chemicals are not available. The cleanup levels are based on use of surrogate chemicals.

benzo(g,h,i)perylene surrogate: pyrene

phenanthrene surrogate: anthracene

-- = not applicable

RAG = remedial action goal

CONCLUSION:

The calculations in Table 1 demonstrate that the 100-N-25 waste site meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2006b) and SAP (DOE-RL 2006a). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

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CALCULATION COVER SHEET

Project Title: 100-N Field Remediation **Job No. 14655**

Area: 100-N

Discipline: Environmental *Calculation No: 0100N-CA-V0153

Subject: 100-N-25 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 3 Total = 4	J. D. Skoglie	C. H. Dobie	N. K. Schiffern	D. F. Obenauer	12/20/12

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	10/15/12	Calc. No.:	0100N-CA-V0153	Rev.:	0
Project:	100-N Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/15/12
Subject:	100-N-25 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 100-N-25 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) for the 100-N Area (DOE-RL 2006), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) BHI, 2005, *100 Area Analogous Sites RESRAD Evaluation,* Calculation No. 0100X-CA-V0050, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

2) DOE-RL, 2006, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area,* DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

3) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code,* 1996.

4) WCH, 2012, *Remaining Sites Verification Package for the 100-N-25, French Drain 1 Liquid Waste Site,* Attachment to Waste Site Reclassification Form 2012-079, Rev 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	09/13/12	Calc. No.:	0100N-CA-V0153	Rev.:	0
Project:	100-N Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	09/13/12
Subject:	100-N-25 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No.	2 of 3

METHODOLOGY:

The 100-N-25 waste site is comprised of one decision unit for verification sampling, consisting of the excavation area. The protection of groundwater hazard quotient and carcinogenic risk calculations for the 100-N-25 waste site were conservatively calculated for the entire waste site using the statistical or maximum value for each analyte (WCH 2012). Based on the generic site RESRAD model (BHI 2005) and a vadose zone thickness of approximately 21 m (69 ft), a K_d of 3.6 or greater is required to show no predicted migration to groundwater in 1,000 years. Nitrogen in nitrate and nitrite requires HQ and risk calculations because they are detected above the Washington State or Hanford Site background value, and has a K_d of less than 3.6. Boron is included because it has a K_d of less than 3.6, and no Hanford background value has been established. All other site nonradionuclide COPCs were undetected, quantified below background levels, or have a K_d greater than or equal to 3.6. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (µg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720 (3)(a)(ii)(A), (1996) x 100 x 1 mg/1000 µg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii) (A) (1996). For example, the statistical value for boron of 1.4 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 4.4×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for the 100-N-25 waste site is 1.1×10^{-1}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1×10^{-6}. There were not any constituents in this calculation that had a carcinogenic RAG associated with it. Therefore, the requirement of $<1 \times 10^{-6}$ is met. Furthermore, the criterion for cumulative excess cancer risk for carcinogens is also met.

4) The soil cleanup RAGs for protection of groundwater are based on the "100 times" provision in WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of ground water at the site." When the "100 times rule" values are exceeded, RESRAD was used to demonstrate that higher soil concentrations may be protective of groundwater.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie JDS	Date:	10/15/12	Calc. No.:	0100N-CA-V0153	Rev.:	0
Project:	100-N Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CHD	Date:	10/15/12
Subject:	100-N-25 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No.	3 of 3

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk >1 x 10^{-6}: None
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None.

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-N-25 Waste Site.

Contaminants of Potential Concern	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.4	320	4.4E-03	--	--
Anions					
Nitrogen in Nitrate and Nitrite	103	1,000	1.0E-01	--	--
Totals					
Cumulative Hazard Quotient:			**1.1E-01**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:
[a] = From WCH (2012).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 100-N-25 waste site meets the requirements for the hazard quotients and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2006).

APPENDIX C

DATA QUALITY ASSESSMENT

APPENDIX C

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2012b). This DQA was performed in accordance with site-specific data quality objectives found in the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (100-N Area SAP) (DOE-RL 2006).

A review of the sample design (WCH 2012b), the field logbook (WCH 2012a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. In addition, ion chromatography (IC) anions analysis, by EPA method 9056, was also requested. IC anions are not contaminants of potential concern (COPCs) for 100-N-25 waste site.

To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 100-N-25 waste site were provided by the laboratory in sample delivery group (SDG) J01572. SDG J01572 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 100-N-25 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

SDG J01572

This SDG comprises 13 statistical verification samples (J1PVN7 through J1PVN9, J1PVP0 through J1PVP9) from the 100-N-25 excavation. This SDG includes a field duplicate pair (J1PVP0/J1PVP9). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, nitrate/nitrite, IC anions, polycyclic aromatic hydrocarbons (PAH), and total petroleum hydrocarbons (TPH). SDG J01572 was submitted for third-party validation. In addition, one equipment blank (J1PVR0) was analyzed for ICP metals and mercury. Minor deficiencies are as follows:

In the ICP metals analysis, the chromium and zinc were detected at low levels in the method blank (MB). Significantly higher concentrations of chromium and zinc were detected in the field samples, and their results are not comparable to the concentrations observed in the MB. However, the chromium and zinc results in the field equipment blank sample (J1PVR0) are

comparable to the equipment blank and have been qualified as undetected and estimated with "UJ" flags by third-party validation. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all silicon results were considered estimates and flagged "J" by third-party validation due to a laboratory control sample (LCS) result below the quality control (QC) limits at 16%. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the relative percent differences (RPDs) for calcium and silicon are above the project QC limit of 30%, at 83% and 39%, respectively. In addition, the RPD for silicon is above the project QC limit of 30%, at 39%. The associated sample results are considered estimates and were flagged "J" by the third-party validation. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries were out of project acceptance criteria for four analytes (aluminum, antimony, iron, and silicon). For aluminum and iron, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for antimony and silicon were 42% and -10%. All antimony and silicon data for SDG J01572 were considered estimates and flagged "J" by third-party validation due to the MS recoveries outside the limits. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. The field QA/QC sample, listed in the field logbook (WCH 2012a), is shown in Table C-1. The main and QA/QC sample results are presented in Appendix B.

Table C-1. Field Quality Assurance/Quality Control Samples.

Sample Area	Main Sample	Duplicate Sample
Excavation	J1PVP0	J1PVP9

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each COPC. Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the

target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

None of the RPD calculated for the field duplicate sample are above the acceptance criteria of 30%. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. No sample results required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-N-25 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the 100-N-25 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

The verification sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

REFERENCES

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